

PAGE'S WEEKLY



ENGINEERING · ELECTRICITY
SHIPBUILDING  MINING
IRON & STEEL INDUSTRIES

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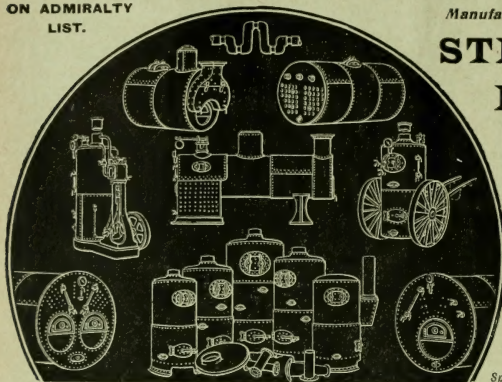
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STEAM BOILERS,

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PAGE'S WEEKLY

Miscellaneous

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Consulting and Organising Engineer for Water Works and Industrial Undertakings.

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Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

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Water stored where most convenient under pressure and automatically distributed.

For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.
Descriptive Circular sent on request.

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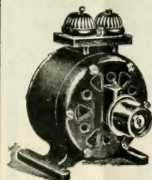
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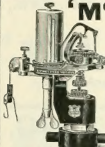
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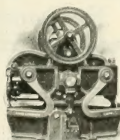
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See our advertisement appearing March 17th, 1904, 45.
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PAGE'S WEEKLY

Miscellaneous

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See our Advertisement appearing March 17th.

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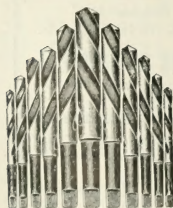
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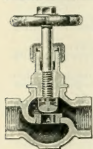
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With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

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HIGH-CLASS NEW MACHINE TOOLS
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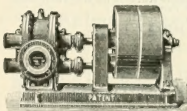
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and

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ENKE'S ROTATIVE PUMP.



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4,000 Pumps under my System (with a capacity up to 15,000 litres per minute) in use.

ENKE'S PRECISION BLOWER.

Entirely of Iron without packing for high pressures to 0.3 atm.

CARL ENKE, Schkeuditz-Leipzig, GERMANY.

PAGE'S WEEKLY

Contracts

CONTRACTS.

WESTERN VALLEYS (MON.) SEWER-AGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive TENDERS for the CONSTRUCTION of the above WORKS, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17½ miles in length varying from 4ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 24in. in diameter, of earthenware and steel pipes; the Cwmillery Branch, about 1½ miles in length, 12in. and 15in. in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes; being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M. Inst. C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATERTON, M. Inst. C.E., 6, The Sanctuary, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned after a contract has been entered into, to every person who has sent in a *bona fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for—Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender. Dated this 10th day of February, 1905.

T. S. EDWARDS,

Clerk to the Western Valleys (Mon.) Sewerage Board.

24, Stow Hill, Newport, Mon.

AXBRIDGE UNION RURAL DISTRICT COUNCIL.

HIGHBRIDGE WATER SUPPLY.

CONTRACT No. 1.

TENDERS are invited for SUPPLYING about 600 TONS of CAST IRON SOCKET WATER PIPES, 7in. to 4in. in diameter, to be delivered at Axbridge and Highbridge Station, or other specified place.

Specification and Quantities, with form of Tender, may be obtained from the Engineer, A. POWELL, M.I.C.E., 3, Unity Street, College Green, Bristol, between the hours of 10 and 5, on Saturdays.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes," to be sent to me, the undersigned, at my office, on or before the 13th day of March. Contractors will be required to deposit £5 for bill of quantities, which sum will be returned upon receipt of *bona fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

WILLIAM REECE,

Clerk to the said Council.

Rural District Council Office,
Axbridge, Somerset, February 15th, 1905.

TO BOILERMAKERS.

CROMER WATERWORKS.—The Cromer Urban District Council invite TENDERS for the SUPPLY and ERECTION of a STEAM BOILER at the site of their new pumping station at Metton, near Cromer.

Particulars with specification and form of Tender may be obtained at the office of the Engineer, Mr. J. C. MELLIS, M. Inst. C.E., 274, Gresham House, Old Broad Street, E.C., on payment of Five pounds, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders are to be delivered or sent in to me at or before noon of Monday, the 13th day of March, 1905.

The Council does not bind itself to accept the lowest or any Tender.

JAMES K. FROST,

Clerk to the Council.

Urban District Council Offices, Cromer.

February 10th, 1905.

VICTORIAN RAILWAYS.—TENDERS

are invited for the MANUFACTURE, SUPPLY, and DELIVERY OF STEEL RAILS AND FISH-PLATES. Tenders, accompanied by the preliminary deposit of £250, must be obtained at the office of the Railway Offices, Melbourne, Victoria, Australia, or at the office of the Agent-General for Victoria, 142, Queen Victoria Street, London, E.C., before 1 p.m., on Monday, April 10th, 1905.

Charge for specification with drawing, 7s. 6d.

COUNTY BOROUGH OF SOUTH SHIELDS.

CORPORATION ELECTRICAL SUPPLY AND TRAMWAYS DEPARTMENTS.

The CORPORATION of South Shields are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with the

ELECTRICITY SUPPLY DEPARTMENT.

CONTRACT No. 67.—One Multitubular Marine Type Boiler, with

Chimney and Mountings.

68.—Two Medium-Speed Open-Type Vertical

Engines for 2,550-kw. Direct-Current

Traction Generators.

69.—Two 550-kw. Direct-Current Traction

Generators.

70.—Traction Switchboard.

TRAMWAYS DEPARTMENT.

CONTRACT No. 4.—Electric Trams, complete with "Brill"

Trucks.

Copies of Specifications, Conditions, Form of Tender, also Form of Contract, can now be obtained from Mr. J. H. CAWTHRA, M.I.E.E., Borough Electrical Engineer, South Shields, on payment of Two Guineas for each Contract, which sum will be returned on receipt of a *bona fide* Tender for each Contract.

Tenders on the form supplied, sealed and endorsed "Tender for Boilers, Engines, Generators, Switchboard, or Trams," as the case may be, must be delivered to me at my offices, Court Buildings, South Shields, on or before noon of the 13th March, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

February 3rd, 1905.

J. MOORE HAYTON, Town Clerk.

CITY OF GLOUCESTER. ELECTRICITY SUPPLY (EXTENSIONS).

The Electricity Supply Committee of the City of Gloucester are prepared to receive TENDERS for the SUPPLY and ERECTION of the following PLANT for the Municipal Electricity Works:—

SECTION A.—Three Lancashire Boilers and Accessories.

SECTION B.—One 600-Kilowatt Generating Set and Accessories.

SECTION C.—Electrically driven Surface Condensing Plant, to

deal with 30,000 lb. of steam per hour.

SECTION D.—Steam, Exhaust, Feed, Drain, Condensing, Water

and Sundry Pipes, Valves, &c.

SECTION E.—An Electrically driven Boiler Feed Pump.

The whole bound up in one specification. Tenders are at liberty to tender for either section, but not for part of a section.

Specifications, with terms and conditions and forms of Tender, may be obtained at the office of the undersigned on and after Saturday, the 25th day of February, 1905, on making a deposit of £5 ss., which sum will be refunded on return of the specification filled up with a *bona fide* Tender. Duplicate copies of the specification £5 ss. each of which £4 4s. will be returned upon receipt of the above-mentioned *bona fide* Tender.

Tenders, sealed and marked "Tenders for Electricity Works," must be addressed to me at the Guildhall, Gloucester, and be delivered not later than 1 p.m. on Thursday, the 16th day of March, 1905.

Each Tender must contain the names of two sureties or a Guarantee Society who will be prepared to execute a joint and several bond for the due performance of the contract in the sum of 10 per cent. of the contract amount.

The Committee do not bind themselves to accept the lowest or any Tender.

GEORGE SHEFFIELD BLAKEWAY,
Town Clerk.

Guildhall, Gloucester,
February 22nd, 1905.

THE SUTTON DISTRICT WATER COMPANY.

CONTRACT No. 1.

WATER SOFTENING WORKS.

TENDERS are invited for the CONSTRUCTION of an Engine and Pump House, Pump Well, Compressor Engine, and Lime House, Softening and Lime Water Tanks, Laying and Joining Cast Iron Pipes, Laying Drains, Forming and Making of Paths and Roads, Driving Tunnel, and various other necessary Works at the Company's Pumping Station, Sutton, Surrey.

Tenders must be accompanied by complete priced bills of quantities and schedule of prices, the bills and schedule to be together in a separate sealed envelope, which will not be opened unless the Tender based upon same is provisionally accepted or permission is granted by the parties tendering. All bills and schedules will be returned except those from the contractor whose Tender is accepted.

Drawings may be seen and copies of the specification and bills of quantities obtained on and after Monday, March 6th, 1905, at the offices of the Engineer, W. VAUX GRAHAM, Esq., M. Inst. C.E., 5, Queen Anne's Gate, Westminster, on payment of £5, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders upon the form provided, endorsed "Tenders for Softening Works, Sutton," must be forwarded to P. ANDERSON, Esq., F.C.I.S., Secretary, The Sutton District Water Company, Carshalton Road, Sutton, Surrey, on or before Monday, the 20th day of March, 1905.

PAGE'S WEEKLY

Contracts

GREAT WESTERN RAILWAY.

The DIRECTORS of this Company are prepared to receive TENDERS for the SUPPLY, DELIVERY, and ERECTION of the FOLLOWING PLANT in connection with their Electricity Generating Station at Park Royal and proposed Sub-Stations and Distributing Centres at various places:—

SPECN. 11.—High and Low Tension 3-Phase and Direct-current Switch-boards and Battery Boosters at Park Royal. All Sections must be tendered for.

SPECN. 14.—3-Phase Static Transformers and High and Low Tension Switch-boards at various Sub-stations and Lighting Distributing Centres between Paddington and Park Royal and Paddington and Hammersmith. All Sections must be tendered for.

SPECN. 15.—High and Low Tension 3-Phase and Direct-Current Switchboards at Royal Oak, Shepherd's Bush, and Old Oak Common Sub-stations.

Sec. A.—3-Phase Switchboards.

" B.—Direct Current Switchboards.

" C.—Six Motor-driven Boosters (Four Reversible and two Miling) in connection with Storage Batteries at Royal Oak and Shepherd's Bush Sub-stations.

All Sections should be tendered for if possible, but Tenders for Section A alone or for Sections B and C together will be considered. The Company reserve the right of accepting a Tender for any one of the different Sections alone.

Copies of the Specifications, Forms of Tender, Drawings and General Conditions can be obtained on and after Tuesday, the 14th instant, at the offices of the Consulting Engineers, Messrs. KENNEDY and JENKIN, 17 Victoria Street, London, S.W., between the hours of 10 a.m. and 4 p.m., on payment of Two Guineas for each Specification, which will be refunded on the receipt of a *bona fide* Tender. The fee, which must be paid by cheque, will not be returnable until the Tenders have been adjudicated upon.

Tenders, addressed to "The Secretary, Great Western Railway, Paddington Station, W.," and marked outside "Tender for Electric Power and Lighting—Specification No. 11," 14, or 15," as the case may be, will be received on or before Monday, March 13th.

The Directors do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of a Tender.

G. K. MILLS,

Secretary.

Paddington Station, London, February 8th, 1905.

CITY OF PETERBOROUGH.—WATERWORKS.

ETTON EXTENSION.—CONTRACT No. 3.

The Corporation of Peterborough are prepared to receive TENDERS for the SUPPLY and ERECTION of the following PLANT:—

SECTION No. 1.—Lancashire Boilers, Superheaters, and Economiser.

SECTION No. 2.—Triple-Expansion Vertical Engines, Pumps, Electric Lighting Set, Travelling Crane, Workshop Fittings, and Tools.

SECTION No. 3.—Piping, Injector, Feed Pump, Tank, and Feed-Water Softener.

The whole bound up in one specification.

Persons tendering are at liberty to Tender for any Section or Sections, but not for part of a Section.

Specifications, with terms and conditions, and forms of Tender may be obtained from the undersigned on deposit of Three Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tenders for Waterworks Plant," to be delivered at my office on or before Thursday, the 23rd day of March, 1905.

The contractor will be required to undertake to pay the standard rate of wages prevailing in the district.

The Corporation do not bind themselves to accept the lowest or any tender.

JOHN C. GILL, Assoc. M.Inst.C.E.

Waterworks Engineer's Office,
Peterborough, March 1st, 1905.

COUNTY BOROUGH OF BOLTON.

COOLING TOWER AND CONDENSING APPARATUS.
The Electricity Committee of the Bolton Corporation invite TENDERS for the SUPPLY and ERECTION of COOLING TOWERS and CONDENSING APPARATUS in connection with their Power Station.

Specification, Form of Tender, and full particulars may be obtained on application to Mr. ARTHUR A. DAY, A.M.I.C.E., M.I.E.E., Borough Electrical Engineer, Spa Road, Bolton.

Tenders, endorsed "Coolers and Condensers," must be delivered to the undersigned on or before March 30th, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,

SAMUEL PARKER,

Town Clerk (pro tem.).

Town Hall, Bolton,

February 24th, 1905.

BOROUGH OF KEIGHLEY.—The Electricity Committee is prepared to receive TENDERS for the following PLANT:—

CONTRACT No. 9.—ONE LANCASHIRE BOILER,
CONTRACT No. 10.—ONE 300 K.W. DIRECT-CURRENT
STEAM DYNAMO. HIGH-SPEED ENCLOSED
ENGINE.

Specifications may be obtained on or after March 6th from Mr. J. M. SMYTH, Borough Electrical Engineer, Electricity Works, on payment of One Guinea for each specification to Mr. ALFRED LISTER, Borough Treasurer, Town Hall, which fee will be returned on receipt of a *bona fide* Tender.

Extra copies may be had for 5s. each, which sum will not be returned.

Sealed Tenders, endorsed "Contract No. —" and addressed to the Chairman of the Electricity Committee, Town Hall, must be delivered not later than 10 a.m. Monday, March 27th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,

GEORGE BURR,

Town Clerk.

Town Hall, Keighley,

March 1st, 1905.

APPOINTMENTS OPEN.

CORPORATION OF LONDON.—OFFICE OF ENGINEER, PUBLIC HEALTH DEPARTMENT.

The Corporation of London are prepared to receive APPLICATIONS for the OFFICE of ENGINEER to the Public Health Department. The salary of the office will be £1,000 per annum, rising to a maximum of £1,500 per annum.

Candidates must not be over 50 years of age, and must be members of the Institution of Civil Engineers.

Associate Member of the Institution of Civil Engineers is not sufficient qualification.

Full particulars of the duties of the office and form of application, may be obtained from the Town Clerk, Guildhall, E.C.

The last day for receiving applications on the prescribed form will be Saturday, March 18th next.

BELL,

Town Clerk.

Guildhall,

February 25th, 1905.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR

India in Council will, in the Summer of 1905, make not less than ELEVEN APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department, in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday, 1st May next.

A. GODLEY,

Under Secretary of State.

India Office,

February 24th, 1905.

BOMBAY, BARODA, AND CENTRAL

INDIA RAILWAY.

The Directors are prepared to receive APPLICATIONS (by letter only) from duly qualified candidates for APPOINTMENT as an ASSISTANT CARRIAGE and WAGON SUPERINTENDENT in the service of the Company in India.

Candidates should not be more than 35 years of age, and must have had a good general and technical education.

Other qualifications being equal, preference will be given to candidates who have served their time in the carriage shops of a railway company, or of a large railway carriage and wagon builder in the United Kingdom.

A knowledge of electricity is desirable, but a candidate must have a thorough knowledge of woodworking, general machine, smithy, and hydraulic tools.

Terms: A five years' agreement, with first-class free passage to India. Salary: Rs. 600 per calendar month.

The candidate selected will have to pass a medical examination by the Company's consulting physician before appointment.

Letters of application, accompanied by a brief record in chronological order of the candidate's career, with dates and copies (not originals) of testimonials, marked outside "Assistant Carriage and Wagon Superintendent," should be addressed to the undersigned not later than 15th of March next.

Offices, Gloucester House,

Bishopsgate Street Without, London, E.C.

February 22nd, 1905.

T. W. WOOD,

Secretary.

BUYERS' DIRECTORY.

NOTE.—The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.

John Z. Thom, Patricroft, Manchester.

Belting.

Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.

Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Harley & Sugden, Ltd., Halifax.

Boilers (Water-tube).

Babcock & Wilcox, Ltd., Oriol House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

Bolts, Nuts, Rivets, etc.

Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.

Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 155, Strand, W.C.

Cables.

St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.

Hy. Miller & Co., Millgate Works, Leeds.

Catalogues, Printing, &c.

Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spotiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.

Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).

David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.

Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.

Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Muiries-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.

Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.

Gibbs, John, & Son, 85, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.

South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.

Adolf Heichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).

Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.

Joseph Booth & Bros. Ltd., Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.

Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).

E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.

Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.

Delange & Cie, Mcc., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.

E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).

Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.

Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phoenix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 26, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.

Ablers, Ad., Whitley Bay, near Newcastle-on-Tyne

Engines (Locomotive).

Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).

Alla-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Muiries-Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).

Jno. Fowler & Co. (Leeds) Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.

Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.

Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Fans, Blowers.

Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 85, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.

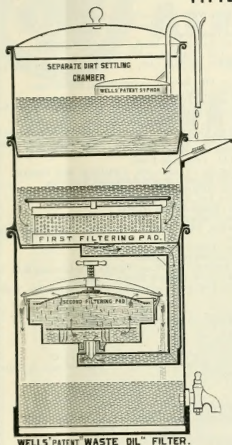
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY Wells' Specialities

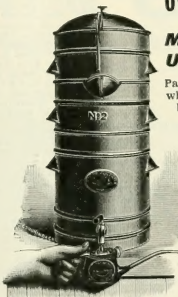
WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.



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OVER 10,000 SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

- No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in. ... 35/-
 No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ... 50/-
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 No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ... 110/-
 No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ... 189/-
 No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in. ... 336/-

Capable of dealing with 250 Galls. Oil per week
 LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

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| No. 6. | Handy Size. No Tank. On Wheels. | £7 7s. |
| No. 4. | Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals. | £8 10s. |
| No. 4A. | Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. | £9 10s. |
| No. 5. | Same capacity as No. 4 Machine. With 5 ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals. | £10 10s. |
| No. 5A. | Ditto Ditto fitted with Wheels. | £11 15s. |

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

Price 13/8 per cwt.,

Carriage Paid in England and Wales. (11 in lots of 3 cwt. at a time, 12/8 per cwt.)

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

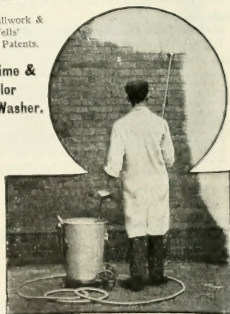
Works: Cheetham, Manchester.

LONDON, N.W.

WELLS' "LIGHTNING"

Wallwork & Wells' Patents.

Lime & Color Washer.



No. 4a, with Wheels.

Buyers' Directory—(Continued).

Firewood Machinery.

M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.

Mable, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.

Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).

J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.

Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.

Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.

J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gearing.

Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. E., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.

Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.

Blummann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).

Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.

See Conveying Machinery.

Horizontal Boring Machines.

Greenwood & Batley, Abillon Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.

Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.

H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.

Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.

Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farley Iron Co., Ltd., Leeds, England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Ma'hill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).

F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.

Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Laundry Machinery.

W. Summerscales & Sons, Ltd., Engineers, Phoenix Foundry, Keighley, England.

Lifts.

Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.

Blummann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.

George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
By, Herry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadbath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Strick & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Abillon Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.

Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.

Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).

W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.

Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.

Halden & Co., J., 8, Albert Square, Manchester.
Hull & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Rope-maker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.

Blummann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.

Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S. Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).

Metallic Paint Co., Ltd., Cardiff.

Paper.

Leopard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.

Page & Rowlingston, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Aerial Ropeways

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AËRIAL ROPEWAYS

AND INCLINES ON ALL SYSTEMS

CONSTRUCTED BY

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Ropeway constructed at Queen's Ferry, Flint, for conveying coal and depositing over a given area.

Ropeways constructed to convey from 50 to 2,000 tons per day. Suitable for the transport of all descriptions of materials.

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Telephone: 2117/ALBANY.

Works: Millwall, E.

LONDON.

Buyers' Directory—(Continued).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 30, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Killett & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Sun, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spou, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 120, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. F. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangye & Co., Ltd., Cornhill Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King's Cross, near Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phoenix Works, Stoke-on-Trent

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Field Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd., Cambridge.

Stampings.

Thomas Smith & Sons of Salford, Ltd., Birmingham.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bras., 10, St. George's Crescent, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Scottish and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Wian, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Weighing Apparatus.

W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitham, Surrey.

PAGE'S WEEKLY

Miscellaneous

Boltons' Downtake Superheater

WITH DOUBLE CIRCULATION.

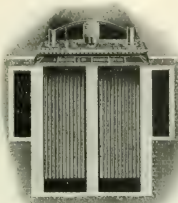
IMPROVED BOX AND "FIELD" TUBES. (PATENTED)

Simple and Reliable. Readily Applied. Inexpensive.
Saves 10 to 15 %
Is made of Steel throughout.

A large number working in—
Textile Mills,
Paper Works,
Collieries,
Electricity Stations,
Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

Approved of by Leading Engineers and Insurance Co's.



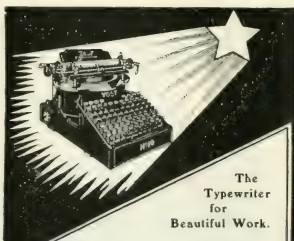
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Engineers and Superheating Specialists,

49, Deansgate, MANCHESTER.



The Typewriter for Beautiful Work.

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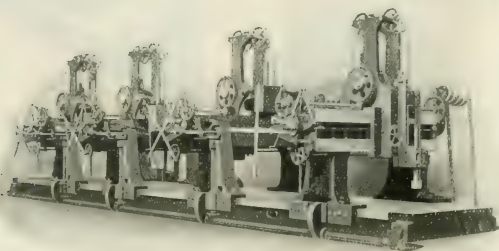
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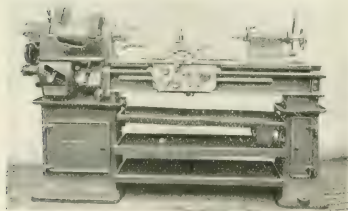
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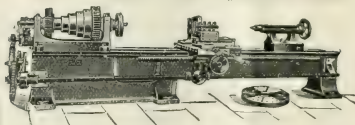
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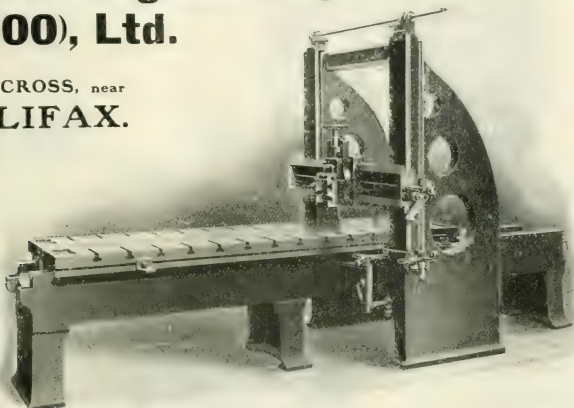
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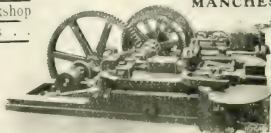


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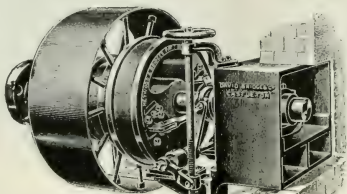
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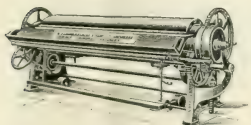
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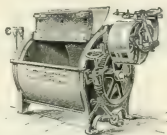
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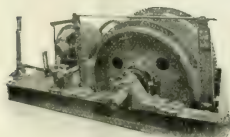
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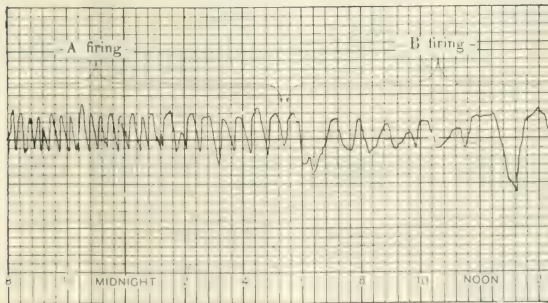
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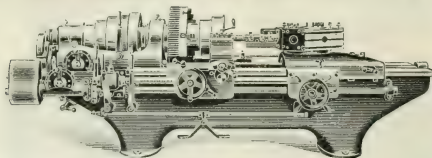
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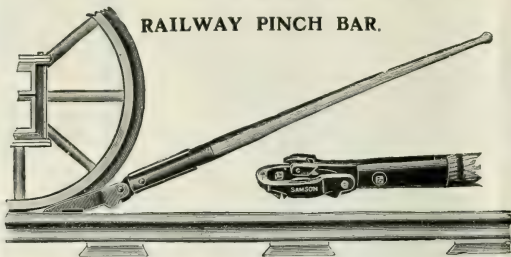
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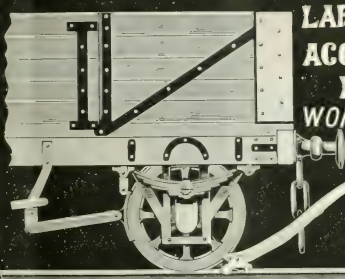
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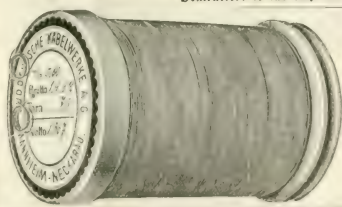
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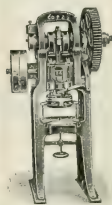
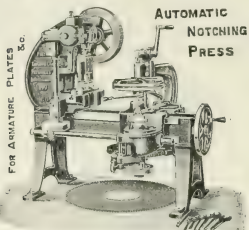
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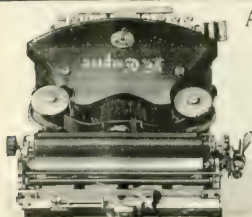
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Vol. VI.

LONDON, FRIDAY, MARCH 10, 1905

No. 26.

The Offices of "Page's Weekly," Wednesday Evening.



EARL CAWDOR, who is succeeding Lord Selborne as First Lord of the Admiralty, will bring an excellent business experience with him into his new office. His most important public appointment hitherto has been the chairmanship of the Great Western Railway, in which capacity since 1895 he has exhibited a decided capacity for commercial affairs. The new First Lord has had not a little Parliamentary experience, having sat in the House of Commons as Viscount Emlyn for some eleven years before succeeding to the title in 1898. Politically Earl Cawdor is comparatively young, having been born in 1847. He is Lord Lieutenant of Pembrokeshire, an Ecclesiastical Commissioner, and has served on the Carmarthen-shire County Council.

In his report just presented on the iron and steel exhibits at St. Louis, Mr. E. S. Bell, our commercial agent in the United States, is able to give a very satisfactory account of British iron and steel exhibits, but he laments the fact that British engines were a minus quantity. We quote the following: "Considering the large number of manufacturers in the United Kingdom it is a great pity that no one could see their way to furnish an example of British skill. The question

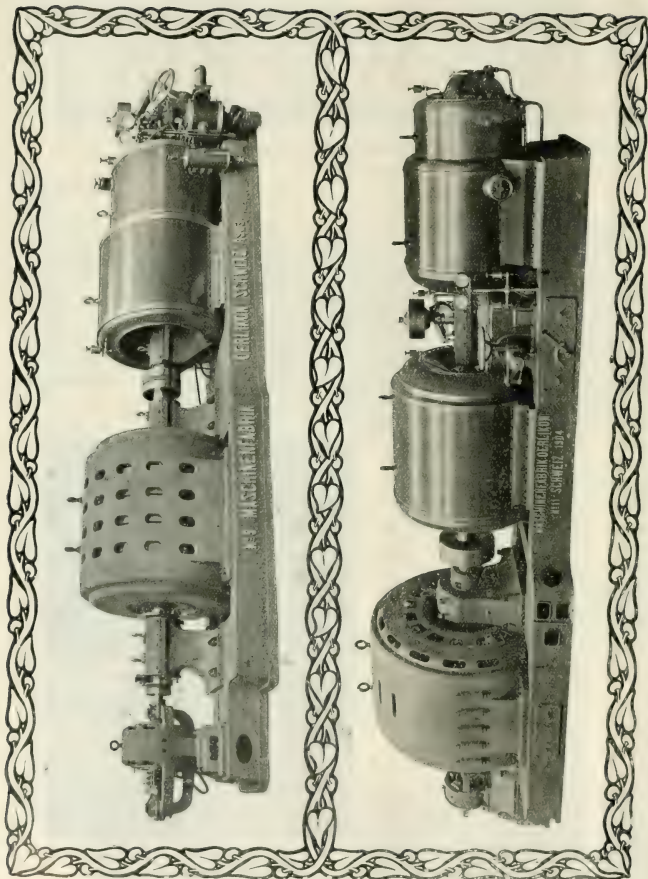
was asked, and probably more than once, at the St. Louis Exhibition, 'Has England given up making engines?' It certainly would appear so to those visitors who have heard of the British reputation and who seek in vain for some example to prove that reports are not false. The plea that the high tariff is prohibitive, though true to a certain extent, does not apply in all cases. . . . It must



MR. JOHN GAVEL.

MR. JOHN GAVEL, CHIEF MINISTER,
ENGINEER & CIVIL ENGINEER, PORT OFFICE.

When the first of the new engines was made, it was the first of the new engines made.



RECENT TURBINE INSTALLATIONS (IV).—TURBO-GENERATORS BY THE MASCHINENFABRIK OERLIKON, ZÜRICH.

(1) The upper picture shows a "Three phase Turbo-generator of 250 kilowatts, 3,000 revolutions per minute." The photo represents the normal type of these machines for output, variable speed, and steam turbine consists of a single cylinder and is coupled directly to the generator by means of an elastic coupling. The bearings of the generator by means of a rotary pump. The bearings of the turbine are placed outside the steam chamber and are lubricated the same as above. The turbine is divided into a high pressure cylinder, in order to allow the bearing to be placed outside the steam chamber, and to be easily accessible.

be remembered that in sending exhibits to an exhibition like that of St. Louis it is an advertisement to the whole world. Visitors from South America and other countries, of which there are immense numbers, look for articles they require, and not only for new ideas. When they see what they want made by America, Germany, France, and others, they naturally buy from them in preference to the United Kingdom, whose manufactures they cannot see. It appears too much to the visitors as though British manufacturers had given up the fight in favour of other countries. The uninformed look upon it as a sign of weakness, while other countries make the most of their opportunities and encourage buyers in their belief."

— — —

That orders are not looked after by British manufacturers as they might be is instanced by a conversation Mr. Bell had with a representative of an American concern working under British patents. This representative declared that he had received personal inquiries from visitors from Europe for some of their manufactures. He had to refer them to the British house, which was unrepresented at the Exhibition, as his company is prohibited from selling in Europe. This is quoted by Mr. Bell to show how easily orders may be lost when a comparatively small outlay would show the goods to the world. As we all know, there is another side to this question, and when we reflect upon the number of British ideas which have been exploited in the States, the diffidence of British manufacturers is more easily understood.

A somewhat belated report of the students' address, delivered by Mr. James Swinburne, on "The Theory of Electricity and the Value of its Study to Engineers" has just come to hand from the Institution of Civil Engineers. Needless to say, Mr. Swinburne makes out a very good case for the study of electricity, pointing out, first of all, that it is the best example of the

application of a large number of branches of mathematics. Probably this one subject, the theory of electricity, is the best study for those who wish to learn mathematics through physics, and to gain at the same time a knowledge that is the foundation of an important industry.

In the course of his remarks on the new theory of the constitution of matter, he remarks that what is urgently needed is a treatise which begins by assuming the existence of electrons, and gives a clear account of what the author conceives them to be, and then proceeds to show how they explain phenomena, and unravel all sorts of tangles, and open all sorts of stage doors of which the hypothesis is the unexpected master-key. As to the direct benefits to be derived from a study of electricity, Mr. Swinburne makes it evident that a modern engineer cannot consider his technical equipment complete without it.

— — —

"Electrical engineering," he says, "has not been developed by engineers with some knowledge of electricity, but by electricians and other people who have often had very little knowledge of engineering. The early dynamos were made by opticians. The early gramme rings were driven on to wooden hubs; and for a long time the field-windings were painted red, because it looked like sealing-wax varnish. Opticians used sealing-wax varnish first as an insulator, until it came to give the correct scientific look to all electrical instruments, just as badly designed hand-finished brass-work with hand-chased screws is necessary in other scientific instruments. As dynamo machines got larger they came more into the hands of engineers. In fact, engineers owe a great deal to the dynamo. It was the dynamo that produced the steam turbine. The Parsons turbine for marine propulsion would probably never have existed if the inventor had not begun on the dynamo. The modern high-speed engine also owes its existence largely to the dynamo."

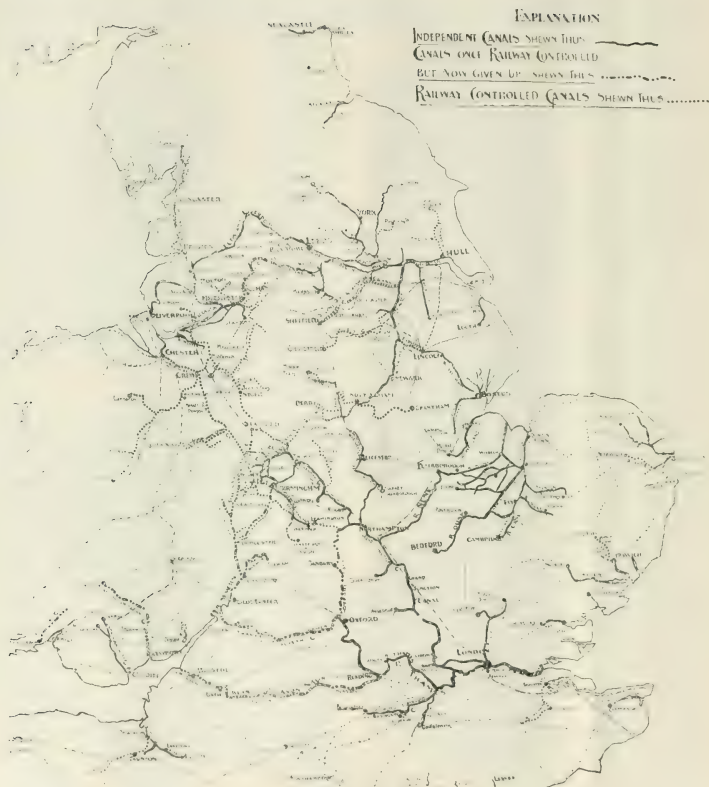


FIG. 1. SKETCH MAP OF THE INLAND NAVIGABLE CANALS AND WATERWAYS IN ENGLAND AND WALES, SHOWING THE WATERWAYS UNDER, AND INDEPENDENT OF, RAILWAY CONTROL.

(See page 534.)

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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New Copy for Advertisements.

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday**. If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

Lord Selborne, the new High Commissioner for South Africa, will sail for the Cape by the Union Castle steamship *Walmer Castle* on April 29th.

What is claimed to be the best spinning mill in England built from the outset to be driven electrically is being erected by the Acme Spinning Company, of Pendlebury, near Manchester.

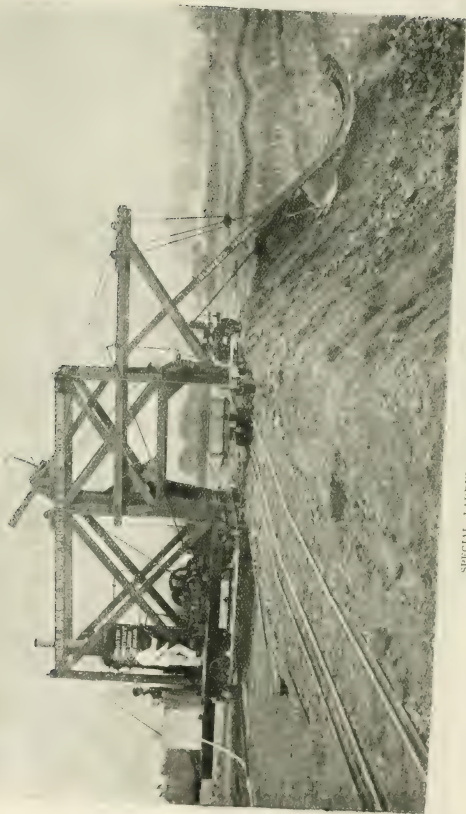
A valuable report has been issued by the Engineering Standards Committee on the experimental work which has been carried out for that committee at the National Physical Laboratory on the temperature rise in the field coils of electrical machinery. The work has been ably carried out by Mr. E. H. Rayner under the direction of Dr. Glazebrook.

On stand No. 20 at the Liverpool Motor Show, Messrs. John Gibbs and Son, ventilating and electrical engineers Duke Street, Liverpool, are exhibiting their new "Peerless Blower," direct driven by their patent dust-proof motor, adaptable for blowing forges or removing dust from polishing wheels. They are also showing a variety of electrically driven ventilating fans and an ingenious patent quick-break safety-starting switch.

A gentleman who says he has been twenty years in the navy and is "getting on in years, so naturally has a tired feeling after hard work," contributes his experiences in an advertisement for the benefit of a certain cocoa firm as follows: "Whilst cruising the other day, one of the blades of our propeller came off, and I had to go and solder a spare one on. It was rather a long and tiring job, and I sincerely believe if it hadn't been for ——— cocoa, I should never have got through it." We should think not, indeed!

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SPECIAL LADDER EXCAVATOR (GLOVER'S PATENT),
BY MESSES. RUSTON, PROCTOR AND CO., LTD., LINCOLN.

**Special Ladder Excavator (Glover's Patent),
by Messrs. Ruston, Proctor and Co., Ltd.,
Lincoln.**

In this excavator the ladder is pivoted at its upper end, and can be raised or dropped at its lower end to any required angle. It is constructed of two channel irons, strongly braced together, and in them runs a trolley, which forms the back of the bucket. The chain is attached to the bucket, and the resistance therefore of the material excavated, to the bucket teeth is met in the most direct manner by the chain, and with the least possible strain on the framing of the machine, whilst the ladder forms a sort of an abutment which keeps them firmly up to their work. The bucket is of one half cubic yard capacity, and is constructed in two parts, hinged together, viz., the back with the trolley wheel mentioned above, and the body carrying the cutting teeth and edge. The bucket, when at work, is lowered to the foot of the ladder, which is then dropped slightly, so that the teeth can get a grip, the clutch of the main engine is next thrown into gear, and the bucket hauled up, cutting a slice off the face of the bank on its journey; when it has reached the top of the ladder a trigger lever engages the back part and holds it, until it is again ready for lowering, at the same time the winding chain is slackened slightly by reversing the engine, causing the bucket body to swing forward, away from the back and discharge the excavated material. The chain is then tightened, until the bucket body is once more drawn up to its working position and so closed. The trigger is next unlatched by means of a cord, and the bucket runs down the ladder again in readiness for another cut. The whole operation of filling, emptying and lowering the bucket ready for the next cut, is completed in thirty to forty seconds. A small independent engine is provided for raising the ladder, and regulating the depth of cut taken by the bucket. By this also the ladder is slightly lifted each time before the bucket is lowered, to allow the bucket teeth to clear the face of the cutting on their way down.

**The Liege Meeting of the Institution of
Mechanical Engineers.**

As already announced, the summer meeting of the Institution of Mechanical Engineers will be held in Belgium, from Monday, 19th, to Saturday, June 24th. An influential reception committee has already been formed by the Society of Liege Engineers. Papers will be read dealing with some or all of the following subjects:

Large Gas-engines; Electric Colliery Winding Gear Superheating in Locomotives; Manufacture of Cartridge Cases; Strength of Columns.

The following is an outline draft of the provisional programme as at present proposed, subject to revision: Monday, June 19th: Arrival in Liège.

Tuesday, June 20th: Morning—Reading and discussion of papers. Afternoon—Visits to the International Mining Exhibition, or to Works in Liège. Evening—Banquet.

Wednesday, June 21st: Morning—Reading and discussion of papers. Afternoon—Visits to the Exhibition, or to Works in the Liège Valley.

Thursday, June 22nd: Whole day visits in the neighbourhood of Liège and Spa.

Friday, June 23rd: Morning—Rail to Brussels. Afternoon—Visits to Works and places of interest in Brussels. Evening—Arrive in Antwerp.

Saturday, June 24th: Visit the new docks and other places of interest in Antwerp, or neighbourhood. Members may be accompanied by ladies on the Thursday, Friday, and Saturday Excursions.

The reception committee, organised by the Liege, Association of Engineers, is as follows: Alfred Habets President; Louis Canon, Vice-President; Charles Thonet, Vice-President; Charles Beer, Jules Bolle, Alphonse Chantraine, H. Cruysmans, Professor Henri Dechamps Baron Edward de Laveleye, Edward de Roubaix, Xavier De Spirlet, Joseph Devillers, Adolphe Firket, Professor Leopold Goret, Professor Herman Hubert, Levi George Montefiore, Adolphe Greiner, Jules Magery, Charles Legrand, J. Leveque-Petit, Edouard Peltzer de Clermont, Auguste Raze, J. H. Regnier, Constant Renson, Louis Schaeffer, Florent Souheur, Carlo Spruyt, Professor Armand Stevart, Gustave Vandeweyer, René D'Andrimont, Secretary.

The Royal United Service Institution—Annual Meeting.

Admiral Sir N. Bowden Smith, in moving the adoption of the report at the 74th anniversary meeting of the Royal United Service Institution, mentioned that the year's working had resulted in a debit balance of £120. Efforts would have to be made to obtain more members or else the expenses would have to be reduced. It was intended this year to celebrate the centenary of the Battle of Trafalgar by holding in the museum between May and November an exhibition of Nelson relics. Colonel Lonsdale Hale, in seconding the motion, mentioned that the total number of members at the end of the year was 5,313, which was a decrease on the previous year of 48. The journal had fully maintained its high position as a service periodical. The motion was adopted.

RECENT DEVELOPMENTS IN ELECTRIC SMELTING IN CONNECTION WITH IRON AND STEEL.

By F. W. HARBORD.

ELECTRIC smelting furnaces may conveniently be divided into three main classes—(1) The induction furnaces; (2) The resistance furnace; and (3) The arc furnace—and all these three are now being employed in the metallurgy of iron and steel. Under existing conditions, the electric furnace can compete with only two methods of steel manufacture, the crucible steel furnace and the open hearth, or Siemens, furnace for the production of high-class carbon and special steels.

THE INDUCTION FURNACE.

The induction type of furnace is a large crucible in which the steel is melted by an induced current

out of contact with any electrodes, completely protected from the action of any furnace gases, and practically protected from oxidation. It gives, from a metallurgical point of view, by far the nearest approach to the conditions of the crucible process, and provided the same care is taken in the selection of the raw materials, a finished product, equal in all respects to crucible steel, is obtained. The best known furnace of this type is the Kjellin furnace, which has been in operation at Gysinge, Sweden, since 1900. Figs. 2 and 3 are a plan and sectional elevation of this furnace.

The amount of energy consumed will vary with the

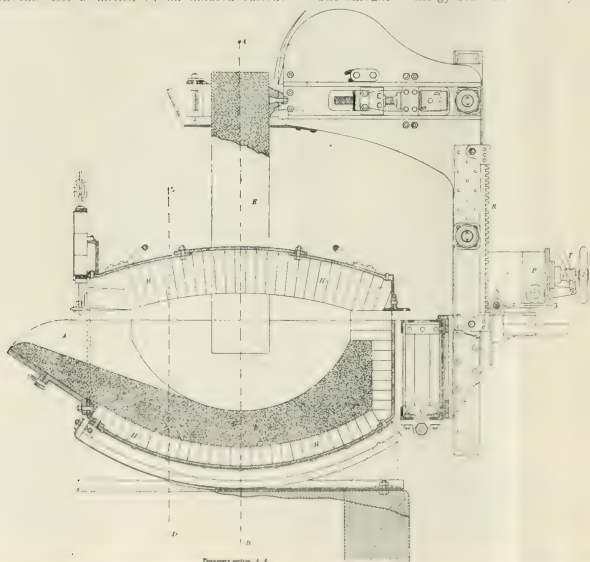


FIG. 1. VERTICAL SECTION THROUGH THE POURING SPOUT OF THE HEROULT FURNACE AT LA PRAZ.

A, Pouring spout; E, suspended electrode, of which there are two, passing through roof; H, base or burnt Dolomite tracks; H', Silica tanks of rest; K, rammed tank material; P, motor and drawing automatic regulator; T, lever for throwing motor; P', out of action; S', hand-wheel operating pinion; S, for regulating electrodes by hand; R, rack gearing, with S, by which electrode is raised or lowered. An alternating current of 450 amperes and 110 volts is used.

difficulty, the former being a special low carbon steel used for transformers.

The following table relates to this furnace:—

Beginning of run, partial gate opening, a.m.	11'40
Full gate opening, p.m.	12'45
End of run, p.m.	7'40
Length of run, total hours	8
Mean voltage	110
Mean kilowatts, partial gate opening	215
Mean kilowatts, full gate opening	340
Total kilowatt-hours	2,580
Mean h.p., full gate opening	462
Total h.p. hours	3,500
Total h.p.-years	0'4
Output of ingots, kgs.	2,341
H.P.-years per ton of ingots (2,240 lbs.)	0'17

Cost of electric energy per ton of
ingot, at 41s. 8d. per h.p.-year . . 7s. 1d.

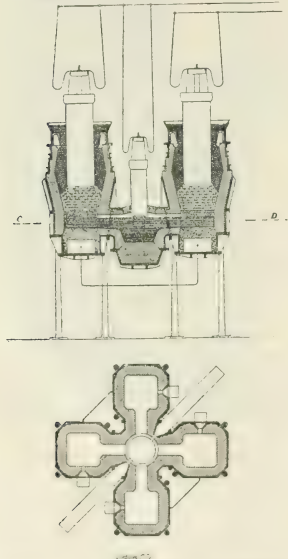


FIG. 4. THE KELLER ELECTRIC HIGH FURNACE WITH A PLURALITY OF HEARTHS.

THE KELLER STEEL PROCESS.

At Livet, at the works of Messrs. Keller, Leleux, and Co., the process of steel-making is not carried on commercially, the chief business of this firm being the manufacture of alloys. They have, however, an experimental furnace of about 35 cwt. capacity, in which they made an experimental heat. The furnace employed was identical, from a metallurgical and an electrical point of view, with the Héroult furnace, differing only in details as to tilting, etc. The electrodes passed through the roof, an alternating current was employed; common scrap was the raw material, and purification was effected by removing and renewing the slag several times. The charge made was of medium carbon, and the energy consumed was about 120 e.h.p. years per ton of ingots made. Assuming that the cost of scrap pig, etc., in the Héroult and Kjellin was the same, the difference in the cost of production would not be more than a few shillings per ton one way or the other. The chief point, however, when one process has an advantage over the other is in the cost of raw material. The Kjellin process, to produce the highest class tool steel, is limited to the best Swedish scrap and the best Swedish pig, or pig and ore, whereas common miscellaneous scrap is the raw material used in the Héroult process. In Sweden this high class scrap can be obtained at a comparatively low figure, but in other countries Walloon scrap, if obtainable at all, which is not likely, would cost probably £12 per ton, and possibly more, and it would most likely be necessary to buy the Walloon bars at the same price as bars for cementation. On the other hand ordinary steel scrap in England can be bought from 50s. to 60s. per ton, so that in countries outside Sweden the Héroult process has a great advantage. So far as analytical, mechanical, microscopic, and workshop tests show, steels can be made either by the Kjellin, Héroult, or Keller process equal in every respect to best crucible steel.

From a commercial point of view, the manufacture of pig iron in the electric furnace is of little interest to the English electrician or metallurgist, as with our cheap supply of fuel no electric furnace can compete with a modern blast furnace. In Canada the conditions are different, so that the possibility of developing their iron ore resources by the electric furnace is a matter of great importance to the colony.

ARC FURNACES.

The Stassano is the best known of this type. The process differs from the Héroult and Keller process in so far that steel is produced direct from the ore in

one furnace, instead of from pig iron or scrap. The ores used are the very purest hematites. The usual charge consists of 350 to 400 kilogrammes of pig iron, 200 to 250 kilogrammes of scrap, the necessary amount of ore being added to oxidise the impurities and sufficient lime to form a basic slag to protect the lining of the furnace, and remove the phosphorus and sulphur in the materials employed. During the last year's working the following data have been obtained: Loss on weight of materials charged, 1.5 to 2.01 as a maximum; consumption of electrodes, 5 kilogrammes per ton of steel produced; mean consumption of current, 1.2 kilowatts per kilogramme of steel produced, equal to 186 e.h.p.-year per ton of steel; six men, an electrical mechanic, melter, and four labourers are more than sufficient for one furnace.

(To be continued.)

Abstract of a paper read before the Paradox Society.

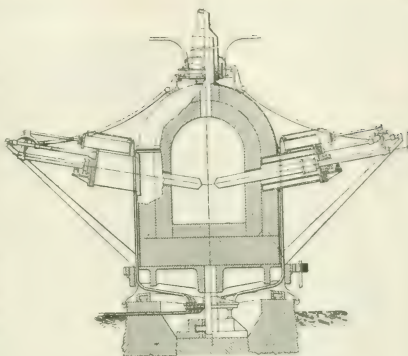


FIG. 5.

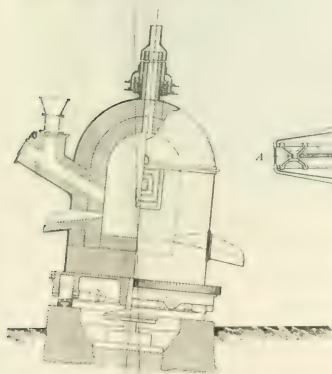


FIG. 6.

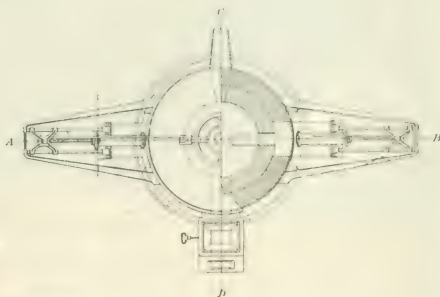
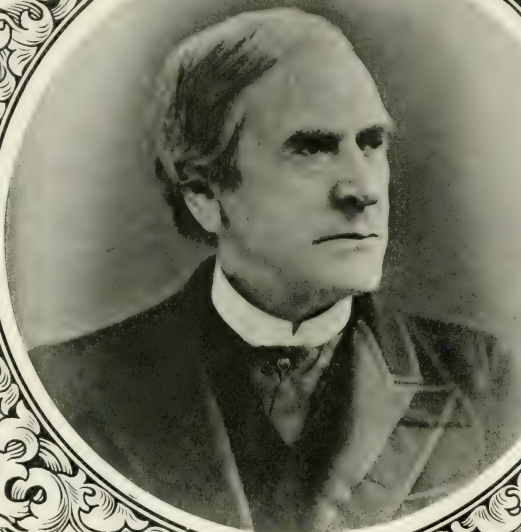


FIG. 7.

STASSANO ELECTRIC FURNACE.

Furnace lined with magnesite bricks. The furnace is supplied through a central shaft with a large, rounded upper section and a narrower lower section. Two horizontal electrodes are positioned on either side of the central shaft, extending into the furnace. The entire assembly is supported by a complex base structure with various mechanical components and pipes.



OUR WEEKLY BIOGRAPHY.

GEORGE H. CORLISS.

THE inventor of the Corliss engine was born at Easton, Washington, on June 2nd, 1817, and was educated at an academy in Castleton, Vt. His inventive genius first manifested itself in constructing a machine for sewing heavy leather, but up to the age of twenty-four he had never seen the inside of a machine shop, nor, with the exception of a sewing machine, had he ever exhibited any decided inclination for invention. In 1844 he took up his residence in Providence, R.I., and shortly afterwards associated himself in

business with Messrs. John Barstow and Edwin J. Nightingale, under the name of Corliss, Nightingale and Company, for the manufacture of steam engines. Here it was that he began the development of his improvements in steam engines, and after about four years he completed and successfully set in operation an engine which embodied the essential features of what is known universally as the Corliss engine. This engine was of the walking beam type, having the regulator combined with the cut-off valves, and developed a capacity of 260 h.p. during the first minute of its automatic regulation of the closing moments of its induction valves. It was constructed throughout with reference to the introduction of this new feature. The cylinder was 22 in. in diameter, and had a stroke of 6 ft., and worked under 60 lb. boiler pressure.

During the same year the works of the Corliss Steam Engine Company were founded in Providence, R.I. They gave employment to a thousand men, but the productiveness of the manufactory must be estimated at a higher rate owing to its being equipped with many labour-saving devices of which Mr. Corliss was the inventor. His letters patent for improvements in steam engines were granted March 10th, 1849.

In introducing the new engine, the inventor adopted the novel plan of offering to take as his remuneration the saving of fuel for a stated period. In one instance a saving of 4,000 dollars was effected in twelve months.

The inestimable advantages accruing from Mr. Corliss's inventions met with world-wide recognition; in 1867, at the Paris Exhibition, he secured the highest competitive prize, although he had more than a hundred engineering competitors. One of the British Commissioners at this exposition—the late Mr. J. Scott Russell, in his official report, said: "The American engine of Corliss everywhere tells of wise forethought, judicious proportion, sound execution and exquisite contrivance."

In 1870 the Rumford medals of the American

Academy of Arts and Sciences were awarded to Mr. Corliss, in presenting which Dr. Asa Gray remarked that no invention since the time of Watt had so enhanced the efficiency of the steam engine.

Two years later Mr. Corliss, under an act of Congress providing for the celebration of the hundredth anniversary of American independence, was appointed a Commissioner for the State of Rhode Island at the Centennial Exhibition in Philadelphia, and was elected one of the executive committee of seven who were entrusted with the preliminary work. The engine, of remarkable dimensions, furnished by Mr. Corliss for this exhibition increased his already widespread reputation; the cost of the undertaking exceeded 100,000 dollars. Eventually this engine was transferred to the town of Pullman, near Chicago, where it was utilised to supply motive power for the extensive works of the Pullman Car Company.

In 1873 the grand diploma of honour was awarded to Mr. Corliss by the Vienna Exhibition—this distinction being exceptionally noteworthy from the fact that he was not directly represented. In 1879 the Institute of France bestowed upon him the Montyon prize—which was regarded as the highest honour obtainable for mechanical achievements. Among other ingenious devices invented by this engineer is a machine for cutting the cogs of bevel-wheels, an improved boiler with condensing apparatus for marine engines, and pumping machinery for waterworks. In February, 1886, the King of the Belgians made him an officer of the Order of Leopold.

Those privileged to be intimately acquainted with Mr. George H. Corliss speak highly of the many admirable traits of his character, and a number of pleasing anecdotes are related of his singular modesty and refinement. A peculiar interest attaches to our portrait of the inventor, which was reproduced from a photograph presented by him, shortly before his death in 1888.

By Mr. B. H. Thwaite, C.E.

BRIDGE LAUNCHING.

By B. J. FORREST, MEM. CAN. SOC. C.E.



THE construction of a bridge may be simple but the erection of the same is governed entirely by local circumstances, and in countries where lumber for false work is scarce, and the cost of skilled labour is high, it is necessary to seek such means of handling the work in the field as will entail as small an outlay as possible for these items.

The particular work to which attention is called, is the erection of several steel bridges for the Central Bahia Railway, South America. The design for these bridges was prepared by the writer, who also had personal charge of the erection, and the bridge selected for description is one of 203 ft. length spanning a deep gorge, the base of rail being about 180 ft. above water level, and the sides of the gorge being very precipitous.

The difficulty of successfully designing the

bridge was enhanced by the fact that this portion of the country is liable to severe shocks of earthquake, and suitable provision was made for the supports of the trusses, as will be described later.

Owing to the cheapness and facility of procuring cement and stone, the abutments and wing walls were built of concrete, the concrete being braced and tied together with old rails and tie bolts as indicated on drawing, since it was found that the adjacent rock was cracked and fissured for a considerable depth. The general lines of cleavage of strata ran north and south, and the direction of oscillations east and west.

METHOD OF ERECTION.

Steel suspension ropes $1\frac{1}{2}$ -in. diameter were carried across the gorge, resting on wooden roller bents at each abutment and connected to a winch at each end. Each half span was assembled, one on each side of the opening, and hauled to the beginning of opening, then the second panel of each from the centre was securely bolted to the hinged top of a temporary wooden braced boom 80 ft. long, which was pivoted on the rock face of the gorge as shown on plan. Near the centre panels of the bridge were placed rolled bearing shoes, which rested on the $1\frac{1}{2}$ -in. suspension ropes. The suspension ropes were stiffened by the use of $\frac{3}{4}$ -in. steel wire rope guys, these were used for alignment, and assisting the hauling ropes in starting, stopping, balancing, and controlling the travel of trusses. The shore ends of the trusses while being launched rested on skids, the ends being counterbalanced as much as possible during the launching. These skids rested on rails, and are shown in the illustration. Powerful screw jacks were used when these skids jammed. Hauling ropes of $\frac{3}{4}$ -in. steel were attached to the trusses, the hauling being accomplished by the aid of a locomotive.

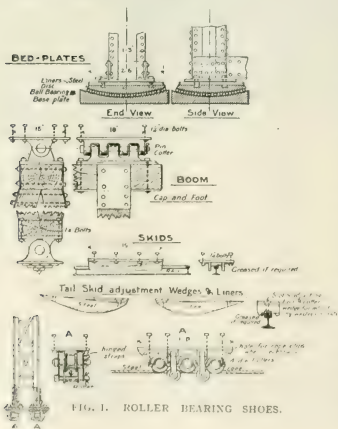


FIG. 1. ROLLER BEARING SHOES.

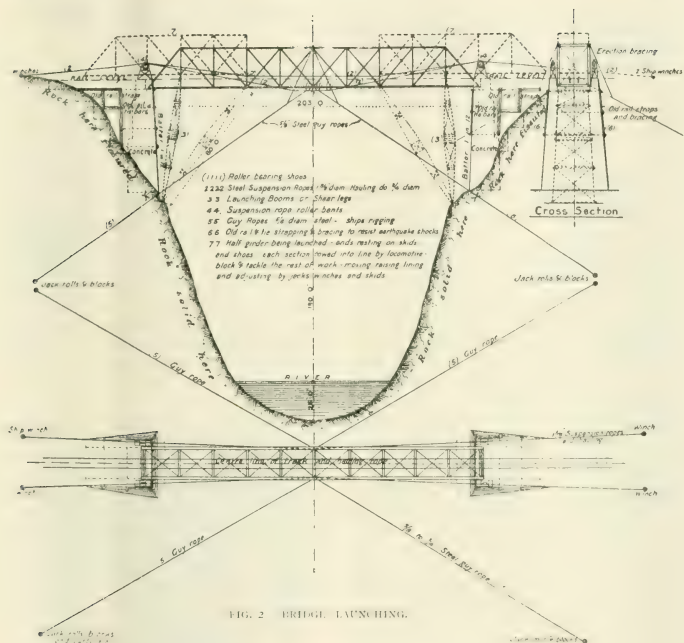


FIG. 2. BRIDGE LAUNCHING.

HAULING AND CLOSING UP THE TRUSSES.

When the ends of the half spans met at the centre of the opening, the closing up and adjustment was done by means of jacks and four powerful cam jaw levers bolted to upper and lower chords of trusses, thus holding them in position while the joints were being riveted up. When this was done the centre and end cross girders and gusset plates and spandrels of upper and lower chords were placed in position, and after these the wind bracing, laterals, floor beams and joists. The greater weight of the truss was carried on the 80-ft. boom.

and the trusses were assembled at such a height that when the two halves met together, the lowering of the top ends of booms would bring the trusses to the necessary height to suit the finished rail level.

The time occupied in launching and closing up the trusses was thirty-six hours, and for fixing platform, raising clearing and closing tracks about one day. Freight traffic was suspended for three days, tracks and approaches raised, and abutments altered to suit the new bridge during this time. Passengers and baggage were conveyed across by means of a

small, low level trestle bridge, while portions of bridge material and urgent freight were carried over on the suspension ropes. The material of the existing bridge, which the new one was to replace on account of increased rolling loads, was removed by means of same booms, gear and tackle as were afterwards employed in launching the new span.

PROVIDING AGAINST EARTHQUAKES.

As before mentioned, special end bearings had to be designed to allow provision for displacement by earthquakes. As will be seen in plate the shoes were of disc form, resting on a number of balls, these in turn resting on bed plates of suitable dished form. This form of bearing was found to work in a very satisfactory manner during earthquake shocks, which gave oscillatory motion at centre of span of about three inches, with no signs of cracks or settlements of abutments or wing walls.

The total weight of the bridge as launched, was about 120 tons, thus giving a load on each launching boom of about 30 tons. Provision was also made for adjusting the rail approaches by the use of four movable track entrance-trussed beams 12 in. by 18 in. fixed at each end of bridge, one end being strapped and bolted to side end of floor beam, the other end resting on cross beam bearers, skids and wedges for facilitating alignment and levelling up of track entrances into bridge after earthquake shocks or settlement of ground.

The cost of erection and launching, including labour, material and transportation of same, was about \$500.00. The material used in construction of the bridge was steel, the unit stress allowed being about 13,000 lb. per square inch for both tension and compression. Maximum deflection at centre estimated at $2\frac{1}{2}$ in. The main joints of trusses at the centre, as also the gusset plates were riveted, all other connections being bolted, chiefly on account of lack of skilled labour and with a view to facilitate speedy erection.

Read before the Canadian Society of Civil Engineers.

Openings for Trade Abroad.

Belgium.

Tenders will be opened on the 5th prox. at the Bourse de Commerce, for the demolition of the metallic turning bridge over the Bruges-Ostend Canal at Breedene, and the construction in its place of a metallic fixed bridge, with a lower passage in masonry. The estimated cost of the work is about £13,665. Particulars may be obtained from the principal engineer, M. De Nys, Rue Coaste d'Argent, Bruges.

On the 29th inst. tenders will be opened at the offices of the "Société Nationale des Chemins de Fer Vicinaux," 14, Rue de la Science, Brussels, for the construction of a section of the projected railway between La Bouverie and Harvengh. The cost of the work is estimated at about £3,722. A deposit of £360 is required to qualify any tender, which must be posted not later than March 28th. Specifications, price 1 fr., may be obtained from M. L'Hoir, 30, Boulevard Dolez, Mons.

British India.

The Assam Administration, being desirous of having the town of Sylhet connected with the Assam-Bengal Railway at Kulaura by a 2 ft. 6 in. gauge steam tramway, are prepared to offer the following concessions to a company or a firm undertaking to construct and work such a line: the provision, free of charge, of the land required for the tramway and its stations; permission to lay the rails upon existing road embankments—with permission to widen if necessary the existing road embankments for the purpose—provided that a clear width of 6 ft. is left for road traffic. An annual subsidy, provided by Local Boards in the Sylhet district, of Rs. 1,000 per mile, to commence from the date on which the tramway is open to traffic, and to continue for a period of ten years. Reduction to 2 annas per cubic foot (converted) of the royalty due on any timber obtained from Government forests for the original construction of the line.

The length of the line would be 33 miles approximately. It is not expected that the Kusiara river would be bridged—at all events for some time to come—and it will suffice if effective arrangements are made to transport passengers and goods across this river by ferry. Similar ferry arrangements may be made on the Surma river opposite the town of Sylhet, the terminal station being situated on the south bank of this river. Applications should be addressed to the Secretary to the Chief Commissioner of Assam, Public Works Department, Shillong.

Thermometers and Pyrometers, with some of their Industrial Applications.

By ROBERT S. WHITTELL.

Continued from page 495.



I HAVE already referred to a recording apparatus designed by Professor Callendar. The instrument consists of a Wheatstone bridge or potentiometer in which the movement of the slider along the bridge wire is automatically effected by delicate relays worked by the current passing through the galvanometer between the bridge arms. According as the moving coil of this galvanometer is deflected in one direction or

of these magnets is mounted on a clock, the movement of which is prevented by a brake. When a current passes through a magnet, this brake is lifted, allowing the clockwork to revolve. The clocks are connected by differential gearing with a recording pen, which is pulled in one direction or the other, according as the brake is lifted from the corresponding clock. The bridge slider moves with the pen and tends to restore balance.

Fig. 10 illustrates a Callendar recorder for determining the temperatures of annealing furnaces and for general thermometric work. The two electro-magnets referred to may be seen in the top portion of the case. The thermometer protected by a porcelain tube is shown on the left-hand side of the recorder.

M. Le Chatelier refers to the recorder as the only one which records high temperatures by purely mechanical means, without the intervention of photography. This statement may not now be strictly true, yet, I believe, the Callendar recorder still provides the most satisfactory way of mechanically drawing a temperature record.

The uses to which a satisfactory recorder can be put are almost innumerable. In Fig. 11 two recalescent curves are produced; one record (A) being characteristic of a mild grade of steel (0.35 per cent. carbon), the other (B) of a finer steel. A comparison shows clearly the value of such records in discriminating between different qualities of steel.

The continuous record of the temperatures, registered by a Callendar pyrometer on the downtake of a Lancashire boiler, will be of

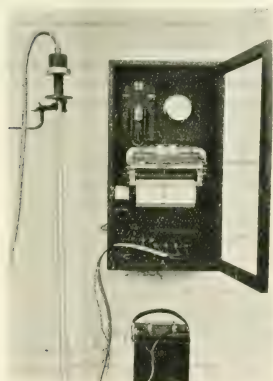


FIG. 10. CALLENDAR ELECTRO-RECORDER WITH THERMOMETER.

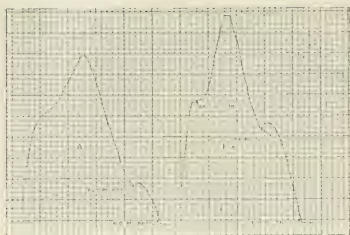


FIG. 11. RECALESCENT CURVES OBTAINED WITH
CALLENDAR RECORDER.

interest to engineers. (see PAGE'S WEEKLY, p. 174, January 27th, 1905). Not less noteworthy is the record (Fig. 12) of the hot-air blast temperatures obtained in a Midland steel works. The construction and electrical connections of the thermometers employed for this purpose are shown in Fig. 13.

On every hand we hear of the "heat treatment" of steel, and anyone who has had anything to do with annealing knows the difficulty of maintaining their ovens or furnaces at a constant temperature. The fireman will go to sleep,

and will swear that he was awake the whole night through, and in many cases will aver still more strongly that the correct temperature was maintained all the time, the master only

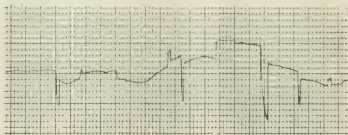


FIG. 12. TEMPERATURE-RECORD OF A HOT AIR BLAST.
Record extends over 22 hours.

learning a few days later from the tests on the material how badly the furnace has been fired. The record (Fig. 14) has been kindly supplied by a firm employing four of these recorders, and it explains how they have overcome the difficulty. The difference in the firing between the two men—the old experienced hand and the new man, who fires more frequently—is very striking. The thermometer (fig. 15) is provided with a heavy cast-iron head, having a large iron flange, which rests on the cover of the furnace.

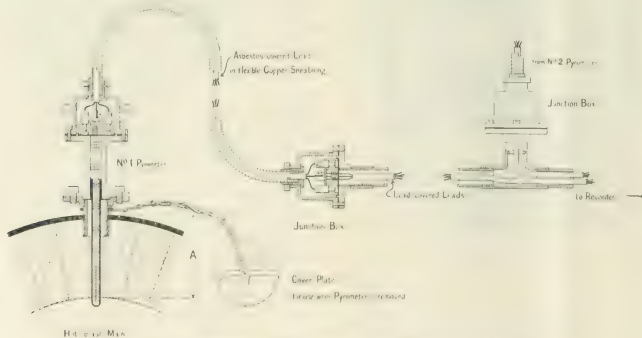


FIG. 13. ARRANGEMENT OF THERMOMETER IN HORSE-SHOE MAIN.

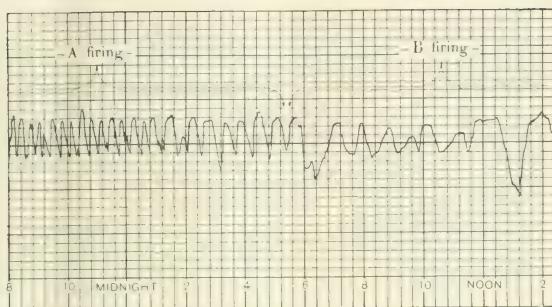


FIG. 14. ANNEALING FURNACE RECORD.

The temperature is above 700 deg. C. Each space on the vertical scale corresponds to 4 centigrade degrees.

I will now give some instances where resistance-thermometers are being used for more strictly scientific work. The first case is, perhaps, one of the more recent. Messrs. Heycock and Neville, whose work on the determination of the melting-points of metals is so well known, have recently been investigating the behaviour of the copper-tin alloys.* This important research, in which many different alloys were included, was carried out by means of these thermometers and a Callendar electric recorder.

The next example will show how extremely sensitive a resistance thermometer may be made. The illustration is taken from Callendar and Nicholson's paper on the "Law of Condensation of Steam."†

The thermometer (Fig. 16) was fixed in the piston rod of a steam engine, and its temperature read by means of a cycle contact-maker, bridge and galvanometer. A record obtained with a similar thermometer inserted in the cylinder cover is shown in Fig. 17. The most striking feature of the curve is the great superheating shown at the end of the compression.

In the latter part of 1903 Sir John Murray

made a series of experiments to determine the temperature of Loch Ness. The thermometer was immersed to a depth of 201 ft., and the temperature was recorded on an instrument at a distance of 1,200 ft. from the thermometer. The thermometer was attached to a cable wound on a drum which was fixed to the deck of a boat moored in the loch, and the cable was connected to the shore cable by means of an elaborate mercury cup.

HEAT RADIATION AND OPTICAL THERMOMETERS.

Many workers have endeavoured to evolve a pyrometer that would measure the temperature of a source of heat without the necessity of inserting a "poker," as the Americans call the ordinary pyrometer.

Taking optical thermometers first, I think that on the whole the one designed by Professor Wanner is the most successful. It is based on the photometric comparison of the intensity of the light emitted by the incandescent body whose temperature is sought with the light of a standard comparison lamp. Instead of using monochromatic light, the light is spread out into a spectrum by a direct vision spectroscop (Fig. 18), and a small region in the red is used. The working standard source of

* Heycock and Neville, *Lectures on the Constitution of the Copper-Tin Alloys*. (Quoted from *A. V. 1902*, p. 100.)
 † Proc. Roy. Soc. London, *Conduction of Heat*, Vol. XXX.

light is a small incandescent lamp. The method of reducing the two fields of light from the hot body and the electric light respectively to the

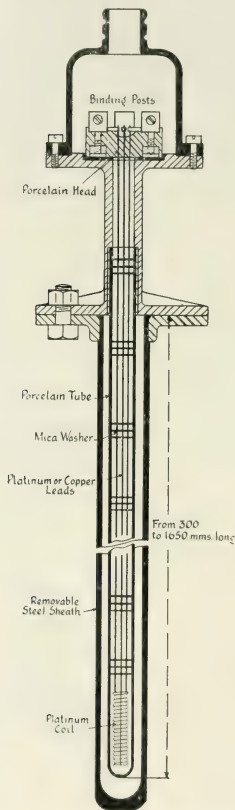


FIG. 15. CONSTRUCTION OF THERMOMETER FOR USE IN ANNEALING FURNACES.

same intensity, is to first polarise them in planes at right angles to each other, and then the intensity of each can be varied by viewing them through a Nicol's prism, which can be rotated. The angular rotation of the Nicol is then a measure of the intensity of the light, and therefore of the temperature. The incandescent lamp can be standardised against an amyl-acetate flame. Owing to the loss of light in the optical system of the pyrometer, the lower limit of temperature measurement with the Wanner is about 900 deg. C., so that it unfortunately cannot be used for determining the hardening and annealing temperatures of many steels. The instrument is capable of considerable accuracy, it being possible to

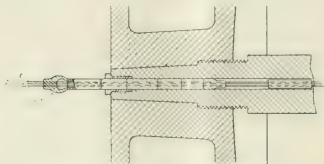


FIG. 16. THERMOMETER FOR DETERMINING THE TEMPERATURE CYCLE IN A STEAM ENGINE CYLINDER.

obtain temperature measurements with it to within 1 per cent.

In Mesure and Nouel's pyrometer-telescope an attempt is made to control temperatures by taking advantage of the rotation of the plane of polarisation of light passing through a quartz plate cut perpendicular to its axis. The angle of rotation is directly proportional to the thickness of the quartz, and approximately inversely proportional to the square of the wave length.

In general the field of view will be coloured, and by turning the analyser the colour observed will change because the light, all polarised in the same plane, emerging from the first Nicol, is polarised by the quartz in various planes depending on the wave length, so that the angle between the two Nicols determines the colour that will be seen. This instrument has the

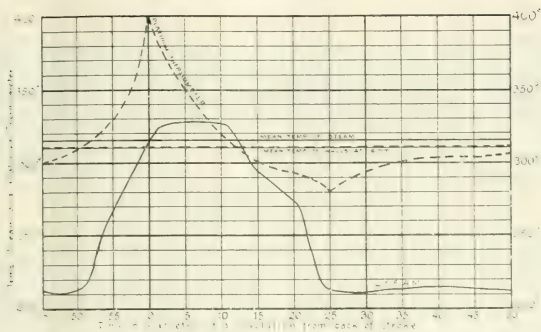


FIG. 17. RECORD OF TEMPERATURE CHANGES IN THE CYLINDER OF A STEAM ENGINE DURING A STROKE.

advantage over others that it has no auxiliary apparatus, but it lacks sensibility.

An ingenious optical pyrometer has been designed by Holborn and Kurlbaum, working at the *Physikalische-Technische Reichsanstalt*.* An incandescent filament is placed in the focus of the eye-piece of a telescope, and by means of an object-glass an image of the source of heat is thrown into the same plane. The current passing through the filament is regulated by means of a rheostat until the filament is no longer visible on the image of the source of heat when both sources of light will have the same intensity.

I do not know of any heat-radiation pyrometer that has been successfully applied commercially. Boys' radio-micrometer, although marvellously sensitive, is too delicate for the rough handling of everyday life. It consists of a loop of copper wire hung in a magnetic field, the two ends of the wire being connected to small plates of bismuth and antimony respectively, and a small copper plate being attached to the junctions. The heat radiation is allowed to fall upon this copper plate. A small electric

current is generated, and the loop which is suspended by a delicate quartz fibre turns, carrying with it a light mirror. Some extremely interesting work has been carried out with one of these instruments; Dr. W. E. Wilson has, for instance, concluded that, supposing the sun to be a dark body, its temperature is 6,590 deg. C.*

Professor Langley designed a radiometric apparatus under the name of a bolometer, which has since been largely developed by Professor Callendar for measuring heat radiations, more particularly solar radiations. It consists of a differential pair of flat platinum-thermometers, one blackened and the other bright, placed side by side in the same horizontal plane in a hermetically sealed glass vessel. The difference of temperature between the two, which is automatically recorded on a Callendar electric recorder, is approximately a measure of the intensity of the vertical component of the radiation to which they are exposed. It has already been shown with these instruments that the heat received by reflection from the sky under certain conditions may amount to more than 40 per cent. of the whole

* See *Phil. Mag.*, Vol. 1, p. 1, 1904.

* See *Phil. Mag.*, Vol. 1, p. 1, 1904.

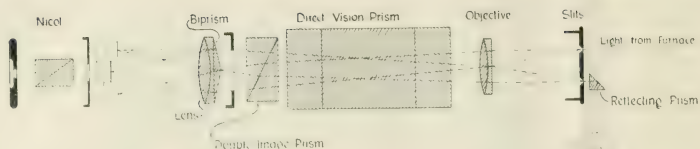


FIG. 18. DIAGRAM SHOWING OPTICAL ARRANGEMENT OF A WANNER PYROMETER.

vertical component. They have also shown what a large proportion the negative radiation bears to the amount of radiation falling on the earth during the day. The radiation is continually varying throughout the whole night.

These instruments have been successfully employed to measure boiler radiation, more especially to compare the relative efficiency of various boiler laggings.

The Siemens' water calorimeter is so well known that there is no necessity to describe it in detail. A ball of copper, iron, or platinum of known weight is exposed to the heat of a furnace, and is then transferred to a vessel containing a measured quantity of water at a known temperature. It can readily be seen that—knowing the rise in the temperature of the water, owing to the insertion of the hot body, and the specific heat of the metal ball employed—the temperature of the furnace can be deduced.

Discrepancies have long been observed between the results obtained with water calorimeters and other forms of pyrometers; but these discrepancies have now been accounted for.

Dr. Glazebrook, in an interesting paper read before the Institution of Mechanical Engineers,* describing the work of the National Physical Laboratory, dealt with the case of the determination of temperature with an iron ball and calorimeter.

A correspondent drew Dr. Glazebrook's attention to the fact that there were considerable discrepancies in the values given for the specific heat

of iron at high temperatures, or, what comes to the same thing, for the total heat emitted by a given mass of iron in cooling from a high temperature. The values generally adopted are those of Pionchon, who based his values on the melting point of silver, taking Violle's value of 907 deg. C. This value is far too low, 962 deg. C. being now generally accepted. Research has shown that if Pionchon's values are corrected by the recent silver value, they may closely be brought into line.

FUSION THERMOMETER.

Reference must be made to the excellent work of Seger in producing a series of porcelain cones melting at various temperatures, and to the work of Mr. Henry Watkin in the same direction.* I would also like to draw attention to an ingenious device invented by Messrs. E. H. Griffiths and W. C. D. Whetham. An iron rod is held rigidly in a steel tube by means of an alloy melting at any given temperature. The rod is free to rotate as soon as the alloy is melted, and can be made to ring an alarm either mechanically or electrically, or to shut off gas, steam, etc. By a simple contrivance it can easily be reset for another experiment.

I feel that I have only touched on the fringe of thermometry and its many applications. The number of these applications must increase as the demand for scientific accuracy increases in all our large industries.

* A paper read before the Cleveland Institution of Engineers, Middleborough.

* See "The Principles of Construction of a Pyrometer for High Temperature," by Henry Watkin—Proc. English Ceramic Society, 1902.



NAVAL NOTES.



WEEKLY NOTES ON NAVAL PROGRESS
IN CONSTRUCTION AND ARMAMENT.

IN OUR NAVAL FORE-CONTINUED.



THE naval estimates for 1905-06 have been received by press and public with a feeling of relief. There can be no doubt that the reduction of the total sum by three and a half millions sterling to £33,389,000 is felt to be a first step in the direction of retrenchment, to which all the leaders of public opinion combine in assuring us we must soon turn if we are to avoid national bankruptcy. But over and above the feeling of relief at the immediate prospect of a slight diminution in taxation there has been noticeable a distinct fear that retrenchment where the Navy is concerned may prove in the long run to be more costly than a continued heavy expenditure. Although Lord Selborne was able to say in his Memorandum explanatory of the estimates, that the fleet has never been in a more perfect state of repair, and though we are all convinced that in efficiency and battle-worthiness, the present condition of the British navy leaves nothing to be desired, there is always the possibility of a return to the bad old days when money for the Navy was only grudgingly given by the Treasury. We shall not always have men like Lord Walter Kerr and Sir John Fisher at the elbow of the First Lord to act as chief naval advisers to the Government.

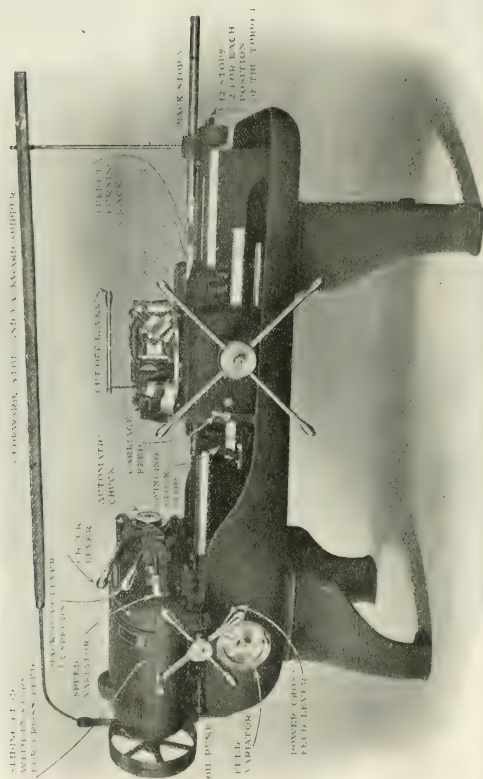
The reduction in the total is mainly made up by the saving in votes 8 and 9, for new construction, armament and repairs. The new shipbuilding programme comprises one battleship, four armoured cruisers, six ocean going destroyers, twelve coastal destroyers, and eleven submarines. The battleship will be called the *Dreadnought*, and is to be built at Portsmouth, while the ship of the armoured cruiser class will be called the *Invincible*. With regard to the construction of this class details are not yet known, but from Lord Selborne's remark in the Memorandum that the first business of the dockyards is to keep the fleet in repair, and that accordingly the

amount of new construction allotted to those dockyards should be subordinated to this main consideration, it may reasonably be assumed that all four will be built in the private yards.

It is in the destroyers that the most interesting feature of the programme is to be found. The ocean-going destroyer is something new in the world of naval architecture, and Lord Selborne has rightly explained the causes which have led the Board to the adoption of this type. In the development of the destroyer class two qualities have successively predominated, speed and sea-keeping power. Their study of the tactical and other questions involved has led the Board to the conclusion that two classes of destroyer are required for the Navy, one for the ocean work and the other for the narrow seas. They have accordingly decided to combine the qualities of speed and sea-keeping power in a special type of ocean-going destroyer which will be expensive, and of which, therefore, the numbers must be comparatively few, and to design a new type of coastal destroyer which will be comparatively cheap, and of which therefore the numbers can be larger.

There is also a reduction in the numbers of the personnel this year only 129,000 being required as against 131,100 last year. This reduction, says Lord Selborne, is a consequence of the policy of eliminating from the Navy those ships whose fighting value is practically nil. Recruiting for the Royal Naval Reserve has been thoroughly satisfactory, and the Royal Naval Volunteer Reserve is also doing well. The number of eligible candidates for service in the navy continues to be in excess of requirements, and altogether the outlook for the Navy is thoroughly satisfactory. Lord Selborne will at least be able to congratulate himself that the last estimates he

thoroughly strong and efficient state, and that they met with approval from publicists and politicians.



LATHE TYPE 2 X 24 IN. HAUGHTON PATENT TURNT LATHE WITH CROSS-FEED HEAD.

NEW FLAT TURRET LATHE WITH CROSS SLIDING HEAD.

BY THE JONES AND LAMSON MACHINE COMPANY.

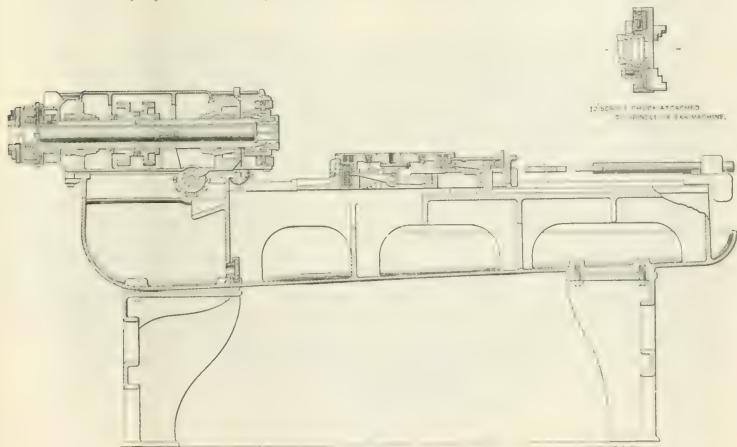
WE were recently afforded an opportunity of inspecting the latest model "Hartness Flat Turret Lathe" at the City premises of the Jones and Lamson Machine Company, and reproduce herewith several illustrations of this interesting machine tool development. In addition to the regular features, built into it during the last fifty years, the new lathe has an important acquisition in the shape of a cross sliding head.

The machine, as it stands to-day, represents the inventive skill of a long train of patentees, and bears witness to the cumulative effect of concentration during a long period upon one particular machine.

The entire plant of the Jones and Lamson Machine Company has for many years been

devoted to the manufacture of the "Flat Turret" lathe, and its equipment of tools. They have, from time to time, produced several modified forms of the machine, the present lathe embodying only those features which have stood the test of practical work in the machine shop.

The "Flat Turret" lathe was introduced in 1891, and is, of course, familiar to the majority of our readers, but for the benefit of the few it may be well to mention the points in which the "Flat Turret" differs from other lathes. In the first place the headstock is mounted on guideways running across the machine, instead of being affixed to the bed. It contains all the necessary gears and clutches for producing all the changes of speed. The carriage carries a flat circular plate-shaped tool-holder from which the lathe



VERTICAL SECTION OF 24 IN. FLAT TURRET LATHE WITH CROSS SLIDING HEAD.

takes its name. The frame or bed is a single casting formed with guideways which run lengthwise for the carriage and crosswise for the headstock. The lower part of the bed casting serves as a receptacle for chips and oil.

The new machine has an ideal scheme of speed regulation. After making trial of several combinations and positions in order to get the best form of self-contained speed variator, it was found advantageous to arrange all the shafting and gearing in a horizontal plane, ample lubrication being obtained by the complete submergence in oil of the lower half of all the running parts. This determined the adoption of the shallow pan-shaped frame for the headstock, which includes all the clutches and bearings. The natural form of bed for holding the headstock made it easy to give the latter a cross travel. The sliding headstock is securely gibbed to the guideways, thus giving the spindle a cross feed relative to the turret, or, in other words, providing a cross feed for each tool. The value of this feature is apparent not only for chuck work, but for many other kinds of work.

The single drive receives power at a constant speed, and in one direction, and all of the changes for variation and direction of speed are obtained by clutches and gears between the power receiving shaft and the spindle. As the pulley receiving the power is driven at a constant speed, it may be belted to a countershaft or to a motor at the head of the machine. An even tension of the belt is maintained by means of a compensating base. High speed steels tax the running bearings of a machine to their limit, and in order to meet this, bronze bearings are used for the driving shafts. They are enclosed in the chamber formed by the headstock and its lid, and receive a continual shower of oil when running. The cross sliding head is provided with ten stops carried in a revolving holder.

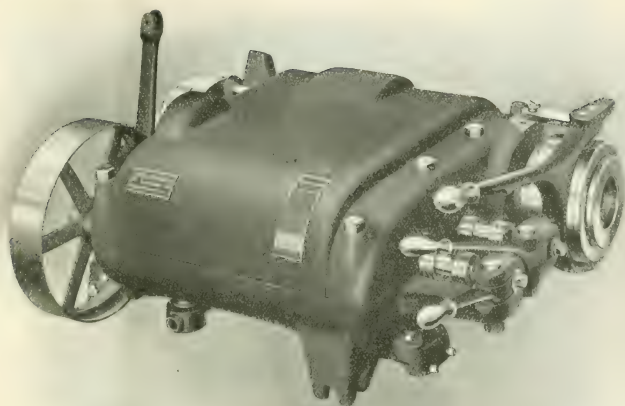
The lathe is made in two sizes, and may be

furnished with an equipment of tools for either bar work or chuck work, or a double equipment for both. The smaller machine, shown on page 524 is known as the 2 by 24, and when equipped with the automatic die outfit of tools it turns out the same work as the original 2 by 24, excepting that the hole through the spindle is now made $2\frac{3}{8}$ in. instead of $2\frac{1}{2}$ in. The general arrangement of the lathe will be understood by a reference to page 524, the various features being clearly indicated on the half-tone block.

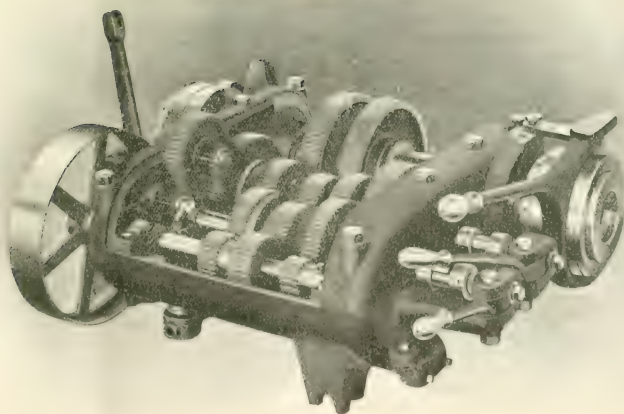
The working range of the lathe is astonishing, the outfit turning all diameters up to $2\frac{1}{2}$ in., and all lengths up to 24 in., and cutting United States standards screws from $\frac{3}{8}$ in. to $1\frac{1}{2}$ in. inclusive, by sixteenths, or Whitworth. Metric or V standard, as desired.

The turner illustrated on page 528 is the result of the natural development of the original turner around which the "Flat Turret" lathe was designed. It is provided with a double adjustment for both the cutter and back rest, but it has lost none of its original convenience and simplicity, and may now be used for turning one diameter only without any inconvenience from extra adjustment.

The quick means for withdrawing the cutter and back rest for opening the turner when passing over a larger diameter are retained. The cutter is of rough 1-in. by $\frac{1}{2}$ -in. high-speed steel. It is held in the pivoted tool block of forged steel, which in turn is accurately fitted to the hollow frame. The adjustment of the cutter is affected by two screws, arranged side by side. These screws take bearing against cams on cam shaft, which is controlled by a handle similar to that used in a machinist bench vise. These cams are diametrically opposite, so that either may be brought into action by a half-turn of the handle. The back rests are controlled by a double latch, in order to obtain the double adjustment. The hollow frame serves as a conduit for the oil, which enters the base of the frame through the turret. The oblong opening

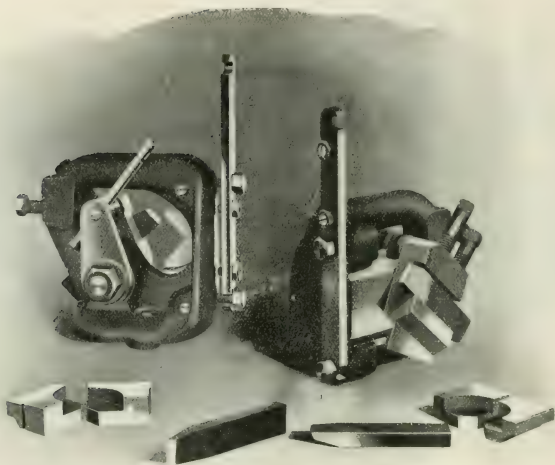


SLIDING HEADSTOCK WITH COVER.



THE SLIDING HEADSTOCK COVER.

This view shows sliding headstock with gears, pinion and other parts, and cover removed.



A GROUP OF TURNERS AND CUTTERS.

in the frame over the cutting tool delivers a large, slowly-moving stream of oil directly on the cutting edge.

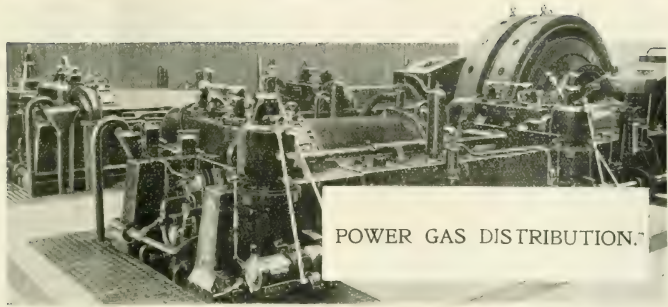
Thanks to the features outlined above, the firm claim to have produced a machine which is always in absolute readiness to make any piece of work of any shape quickly and accurately, and to turn out work in lots of from two or

three to a thousand pieces with turret lathe speed, and the accuracy of a well-handled engine lathe. It is claimed *inter alia* that the "Hartness Flat Turret Lathe" is the only turret lathe having this cross-feed head; that it is the only single-drive turret lathe, and is the only one in which all speeds and feeds are instantly obtainable.

Messrs. Royce Ltd. of Manchester have appointed Mr. J. G. Barber as their representative for the Birmingham district.

We are informed that the directors of the Vulcan Boiler and Insurance Company, Ltd., 67, King Street, Manchester, are arranging with the authorities of the Victoria University, Manchester, to establish a Fellowship for study and research in engineering, but full details of the scheme are not yet arranged.

Messages can now be sent to Cunard mail steamers at any stage in their voyage across the Atlantic. During the first three or four days after the vessels leave Liverpool the messages are sent from Poldhu, Cornwall, direct to the steamer. During the next three or four days the messages are forwarded by cable to the North American Continent and repeated thence to the approaching ship. The charge for the direct messages is 2s. 0½d. per word, and for messages repeated from the other side 3s. 0½d. per word.



TWIN-COUPLED DUPLEX-CYLINDER SINGLE-ACTING 1,200-H.P. NUERNBERG GAS ENGINE.

Evidence *a propos* of the Dudley Port Power Gas Installation described in our last issue.

IN his evidence before the Royal Commission on Coal Supplies, Professor Burstall remarked that the use of large gas engines for the generation of electricity is now only in its infancy, but it may be taken as quite certain that within a few years we shall see engines of from 4,000 to 5,000 h.p. capable of running with such regularity as to allow the alternators to be run in parallel. The economy of the large gas engine is undoubted.

COULD LONDON BE SUPPLIED?

Asked if he considered there was any limit, or to say what would be the maximum distance which gas could be economically transmitted so as to reach a centre of population such as he described, the Professor said: I think about 80 miles in one transmission would be the limit, that is to say, 80 miles with only one set of pumping. If you choose to take two or three sets of pumping, I think probably about 300 miles is the limit.

That would be large enough for any distance in England?—Yes; it is perfectly feasible to supply London with the whole of the coal that it requires from the Derbyshire and Staffordshire fields.

You mean all the gas?—In the form of gas.

Would you now make clear to us what you mean by the pumping? Taking first your figure of 80 miles, I understood you to say that that could be done with one pumping?—That could be done with one pumping, that is to say, the gas would be led from the producer into an air compressor where the pressure would be raised from that of atmosphere to the required pressure,

inch gauge pressure. That I call the pumping or the compressing, which requires, of course, a certain amount of energy in order to pump the gas up to the compressor, the whole of that energy being expended in the friction in the main.

Professor Burstall further said he had taken 48 in. as being about the largest that would be desirable for one main. It was stated that each stage of 80 miles involved, roughly speaking, a loss of about 13 per cent. of the whole for compression pumping.

THE QUESTION OF LEAKAGE.

Questioned as to possible losses by leakage Professor Burstall said this was a matter upon which they had only the Paris air mains to guide them. There the loss is about .4 per cent. per mile on the ring main of 20 miles in length, but the pressure there is 100 lb. per square inch above atmosphere, and the network is not constructed in the streets in a very good manner. He thought there was reason to suppose that the loss by leakage would be about one tenth of 1 per cent. per mile; that is the maximum amount.

That is assuming that the joints are made tight?—That is assuming a mechanically-made joint.

Is there any difficulty with regard to the joint itself, do you think?—None whatever; I have seen joints that have kept very high pressure indeed on them for unlimited times without showing any leak whatever.

Passing over some further questions in the course of which Professor Burstall said he thought we should very shortly see gas engines in this country of 4,000 or 5,000 h.p., we come to the following:—

the mechanical efficiency, and so on. So far as you know, is there any movement in the direction of what you have been giving us in this interesting evidence?—Yes, the South Staffordshire Mond Gas Company have Parliamentary powers to distribute producer gas over a certain section of South Staffordshire, and a great deal of that plant is made, and the pipes are being actually laid in the roads.

In what part of South Staffordshire are they at work laying pipes?—I could not say exactly what parts, because I have not been over there; but I am told that they are starting to lay their pipes.

And that is a system of producer gas which would apply in the cases you have given?—Yes. Of course, it is a much smaller area than I have contemplated and therefore they are only using a pressure of 7 lb. above atmosphere.

Of course that lessens the cost of transmission?—Oh, quite so.

Is this gas at work anywhere much except at Mond's place, or the industry with which he is connected?—It is mainly being used in chemical works, because of the fact that there they want to reduce their cost to a minimum. There is a large gas plant at Allbright and Wilson's making phosphorus; there is a large producer gas plant at the Solvay Company in America. These are all about 12,000 to 15,000 h.p. There is a large plant at the Castner Kellner.

THE SMOKE NUISANCE.

As I understand, one great point which you make is that by this manufacture of gas you will get rid of smoke?—That is so.

And there will be no smoke whatever?—It is impossible to get any smoke.

But if you were to keep the chimney going for the raising of the coal you would still have the smoke?—But I should not; I should do all the raising of the coal by means of gas engines driving three-phase plant. I should have no steam plants at all.

Then you look forward to the day when these gas producers will be at the pit mouth, and when there will be no smoke, and when power will be transmitted as required throughout manufacturing towns, and for lighting in all parts?—That is so.

Have you made any comparison with regard to the proportion of economy in money that there would be by this process as against coal to-day in its raw state?—I have not made any calculations of that, because that is such a large question that it would mean a very serious amount of work to do; but in general terms it may be stated that there is a very considerable saving indeed over our existing state of affairs, taking everything into account.

You say towards the end of your statement that you would probably save from 30 per cent. to 50 per cent. of the total coal consumed in the country?—Yes.

That is in quantity, I suppose?—In quantity.

Or you would make the same coal do double the work?—Yes.

ANOTHER VIEW.

For a moment we are tempted to feel quite cheerful as to the prospects of a fogless London; but let us see what Sir George Livesey, M.Inst.C.E., and chairman of the South Metropolitan Gas Company, has to say upon the question of gas transmission:—

Do you think the suggestion is a practicable one, that we could be supplied in London from the districts where the coal pits are?—No; not at all; I do not think that is at all practicable. That has been thought of a number of times in past years, but it has always been dismissed as impracticable. The cost of sending the gas would be greater than the cost of bringing the coal.

You mean the cost of pumping it?—Yes.

Is that due to the friction in the pipes?—Yes; and the capacity of the pipes which you would want. Of course, if it were to be pumped, it would have to be pumped under very heavy pressure; otherwise the pipes would require to be such an enormous size.

We quote the following interesting excerpt from the evidence of Mr. Henry McLaren:—

So that, if the gas engine be improved and made more reliable, so as to take the place of steam engines to a considerable extent, we might really hope for a very considerable saving in the actual consumption of coal?—Yes, I think so. I am a steam-engine man, but I cannot shut my eyes to the fact that the gas engine is to be the engine of the future. There are considerable difficulties with the larger engines. The smaller engines can run without jacketing their pistons with water; their radiation is larger and they have jackets round the cylinders. But there are considerable difficulties to overcome before you get to the very large gas engine, *e.g.*, owing to their having to put water into the piston, which is a thing that is flying backwards and forwards, and therefore very awkward to deal with; but I have no doubt that the men who are engaged in the manufacture of the gas engine to-day will bring it to perfection. Thermally considered it is far and away ahead of the steam engine; but for reversing purposes and things like that, the steam engine cannot be beaten.

That is to say for handiness?—For handiness and comfort in working. Another great point is the nuisance of gas engines in towns. We have two gas engines at the Yorkshire College, which have been the bane of my

its. I have had the silencing of them to do. One is a very large one, and we are in a residential neighbourhood, and it is a most difficult thing to deal with; it took years to make it so that our neighbours could live alongside it.

What gas were you burning there?—Town gas at 2s. 3d. per 1,000 cubic feet.

I thought this remedy of yours would have effectually done that?—What do you refer to, may I ask?

"Scrapping" them.—It would have done so; I advocated that, but I could not get the House Committee to go with me.

When gas engines are isolated, say for a small application of power, a small gas engine is infinitely more economical than taking steam to any distance, is it not?—Certainly. I have much more faith in the distribution of gas in bulk and using it in gas engines than I have in the distribution of power by electricity from central stations.

Do you think the distribution costs less?—I think with Mond gas it will cost less—that there will be less loss in the main.

And less condensation?—Yes.

The following is from the evidence of Sir Alfred H. Sturges:

Staffordshire is one of the districts where the Mond gas is being put into operation, is it not?—It is not yet in operation.

You mean it is not yet in operation as regards the public companies supplying it?—Exactly.

But it is in operation, I understand, in the Midlands as regards Mond plant, or a plant for the production of the producer gas has been supplied to particular factories?—I believe it is to a small extent.

Do you yourself look forward to power being conveyed in future by means of gas pipes; because, if so, that will modify the view with regard to large wagons?—I do not think that it will ever make much difference in the coal traffic.

Why?—Because the coal will have to be carried to some central station after all.

A central station in the sense that if you have half a dozen collieries within half a dozen miles, you will have some plant in the middle of them: do you mean in that sense?—No, the plant would be placed somewhere in the middle of where the gas would be likely to be used.

But that is not the view that has been presented to us: the view that has been presented to us is that the coal should be converted into gas practically in the neighbourhood of the colliery and brought to London by means of pipe. That is a scheme I had not heard of.

But is that not the scheme of the Mond Gas Company?—So far as I am acquainted with it, a gas producing manufactory is being erected in a central position in what they call the Black Country, that is practically between Birmingham and Wolverhampton, and it is proposed to distribute the gas throughout the district for manufacturing purposes.

Would the manufactory of the gas be far away from the coal pit?—Not very far, but I do not think it would be a less distance than the average that the coal has to be at present carried to the different manufactories. The manufactories are clustered in the district, and this is a central place in the district for the production of the gas, and the coal will have to be carried to that central place about the same distance that it is at present being carried to the different manufactories to which the gas will be conveyed. I do not know whether I make myself clear.

Yes, I think I understand you, but I am surprised to hear what you say. I will put this proposition: Coal is to be carried ten miles to the place where the gas is to be made, and the distance the coal is to be carried to that point is to be as great from the colliery as it is from the colliery to the factory?—Yes.

But is still to be carried from the place where the gas is manufactured to the factory, which you say would be a distance equally as great?—The gas manufactory is in the centre of the district and of the manufactories using the gas, which surround it at distances from nothing or a few hundred yards up to about six miles. At present the coals are conveyed to these manufactories all the way round.

A distance of six miles?—A distance of six miles on an average.

And it would be still a distance of six miles from the place where the gas is to be made?—Precisely; they are varying distances, but, on the whole, I do not think much would be saved in that way; there might be a little, possibly. There would be this advantage, that supposing the scheme were carried out on such a scale as to supersede the use of coal at all at the works, which is not very likely, there would be an advantage of a larger quantity going all to one spot instead of being distributed to various places.

And the large wagons then would be more practicable?—Yes.

Are there any other points?

Has this plan been applied to any of the large trade manufacturing concerns in your district?—Not yet. It is being applied. I am myself using gas from blast furnaces for driving engines; I am putting up 4,000 h.p. to use the gas for driving engines instead of boilers and steam engines.



IRON AND STEEL NOTES



THE paper by Mr. J. E. Stead, F.R.S., on "Science in the Iron Foundry," concluded in the last number, may be said to have been an elaborate plea for accurate analyses. Some very interesting remarks bearing on this point are made in a paper which was read a few days ago by Mr. F. Adamson, of Shethel, at a meeting of the Manchester Association of Engineers.

Perhaps, says Mr. Adamson, the reason why the Americans can work so well on analyses, is that there is probably not an ironfoundry of any consequence which has not a metallurgist or metallurgical engineer whose duty it is to attend solely to mixings, and accept or reject pig irons as they are delivered. Where one foundry is not large enough to employ one man exclusively, several group together and pay a retaining fee, and as this practice is increasing in favour, it seemingly must be found to pay. This metallurgist is not necessarily a chemist, and a chemist is not always a metallurgist, but when the two can be combined in one man, so much the better.

Mr. H. Souther, of the American Foundrymen's Association, is quoted on this point. He says: A little money spent systematically on the services of a metallurgical engineer (not a chemist) pure and simple, may save far greater sums. It is very much in the nature of an insurance against loss. Conditions may seem so favourable for months at a time possibly; materials may be received of such uniform and satisfactory quality that money spent for expert services will appear to be wasted and therefore the plan discontinued, and then all of a sudden things go wrong.

A good chemist may be able to determine the amount of the various elements in the iron or fuels to the third decimal to the minimum of chemical error. He may be quick to do a large number of determinations per day, but of what use are results without practical interpretation and application? A chemist may become the best kind of metallurgist, but only in one way—personal contact with metal-

lurgical operations in every detail and in several branches. A good share of common-sense is a most necessary and valuable adjunct.

A metallurgist need not be a chemist, but he must know how to use a chemist and the results obtained by a chemist, which is an absolute necessity to a metallurgist. Assuming an engineer of metallurgical matters is employed, then to get the greatest benefit the work must be systematised. Regular tests of product must be made often—if changes are made in mixtures, frequently—or at least in the event of the slightest irregularity of product. They need not be so often if changes are infrequent, or in case of a smooth running, but should never be less often than weekly.

As to the difference between a pure chemist and a metallurgist, Mr. Adamson remarks that the former after analysing for the elements upon which it is customary to report, and finding these within the prescribed limits, would then analyse for some other elements, not usually expected to be present, and finding these, or perhaps one, present, even in very small quantity, would be liable to blame this as the cause of failure. The metallurgist, however, should know the possible effect of such element, and if the fracture of the iron or steel did not give a sufficient indication, would probably call in the aid of the microscope. Then, too, there is what is generally known as the "missing" carbon in steel—this might mislead a chemist, but it would not a metallurgist.

These remarks, continues Mr. Adamson, may be strong, but there are cases on record of British firms, engaging a young chemist who has just finished a term at College, and they expect him to be a thoroughly competent metallurgist as well as a chemist. This is scarcely the opinion of Mr. Souther, but it is not, perhaps, fully realised in all works that metallurgy and chemistry are two totally different things, and both are only sometimes covered by one hat.

An example is given of the methods of American merchants. A large firm, one of the largest American iron and steel merchants, will take a contract for instance from a pipe foundry to supply a given analyses in the pipe for a given test for a fixed price per ton of pig iron, and they will supply a mixture of various brands, giving the buyer the proportions of each to use along with scrap. The traveller, who is also an expert metallurgist, is well paid, his salary reaching as much as \$5,000 per annum. This is a step in advance of the English merchant's practice, says Mr. Adamson, and perhaps our merchants might copy.

Turning again to Mr. Stead's paper it will be noted that he fully recognises the difficulty of a metallurgist and a chemist wearing one and the same "hat." Mr. Stead has probably reached the solution of this difficulty when he says that the founder must take the material available. Having selected a man, his real training must begin on entering the foundry laboratory, and whether or not he develops into a useful metallurgist must largely depend upon his ability and capacity for gaining knowledge.

A document worthy of more than passing attention is the report on the iron and steel exhibits at the St. Louis Exhibition by Mr. E. Seymour Bell, British commercial agent in the United States. This report has just been presented to Parliament. It is gratifying to read that from an instructive point of view that the portion of the British exhibit representing the iron and steel industries was undoubtedly the best in the foreign section. The samples were small and well arranged. It was very comprehensive, and the information supplied concerning each sample was, as a rule, satisfactory. Mr. Bell remarks that there is certainly more satisfaction and instruction to be gained by examining, for example, a dozen small samples of iron ore than by looking at one large piece occupying the same or greater space. The cases in the British section were light and not crowded together, and there was no difficulty in seeing everything clearly. The iron ore samples were representative of the different localities from which they were taken, and the approximate percentage of iron contained in them was given. Though the samples of semi-manufactured products were not numerous, they clearly indicated the great variety of manufactures of iron and steel of the United Kingdom and included cases of samples of pig iron, bars, etc., as well as a case of small but interesting samples of materials employed in the manufacture of special steels.

LAUNCHES.

Messrs. William Gray and Co., Ltd., have launched at West Hartlepool the large steel screw steamer, *Turkistan*, which they have built for Messrs. Frank C. Strick and Co., Ltd., of Swansea and London. The vessel will take the highest class in Lloyd's and is of the following dimensions: Length overall, 384 ft. 6 in.; breadth, 50 ft.; and depth, 30 ft. She is a handsomely modelled vessel of the three deck-type, with poop, long bridge and fore-castle, having very tasteful cabin accommodation in houses on the bridge deck for passengers, captain and officers, and is fitted throughout with electric light.

The vessel has a cellular double bottom and after peak tank for water ballast, and in addition there is a deep tank or hold compartment fitted for water ballast abaft the engine room, giving a total capacity for water ballast of about 2,000 tons. The decks are of steel and iron and all weather decks except in wells are sheathed with teak. The outfit, including steam windlass, steam steering gear, ten steam winches with return exhaust to winch condenser, and marine type donkey boiler is of the most approved description, including Porter's patent derrick sockets for dealing with heavy lifts. The machinery is made by the Central Marine Engine Works of the builders, being of the triple expansion type, with cylinders 28 in., 46 in., and 77 in., and a piston stroke of 48 in. She is fitted with Weir's feed pump and heater and two large steel multitubular boilers working by Howden's forced draft at a pressure of 180 lb. per square inch. The vessel and machinery have been constructed under the superintendence of Mr. Archibald Walker.

Messrs. Furness, Withy, and Co., Ltd., Hartlepool, have launched the fine steel screw steamer *Haverstoe*, which has been built to the order of Messrs. Bennetts and Co., Grimsby. The vessel is over 350 ft. in length with a cubic capacity of about 339,936 ft. She is built of Siemens-Martin steel throughout and takes Lloyd's highest class. All the most modern appliances will be fitted. A cellular double bottom is fitted fore and aft for water ballast, the after peak being also available as a tank. Iron grain divisions and wood shifting boards are fitted throughout. Accommodation for the master and officers will be fitted up on the bridge deck and the crew in the fore-castle. Messrs. Richardsons, Westgarth and Co., Ltd., will supply triple expansion engines having cylinders 24 in., 39 in., 66 in., by 45 in. stroke, with 180 lb. pressure.

INLAND NAVIGABLE WATERWAYS.

BEFORE the Society of Engineers on Monday last, Mr. Benjamin H. Hawwaite read a paper on "The Transport Possibilities of our Inland Navigable Water ways." The following is an abstract —

Engineering science is not without its obligation to the old canal constructors, who provided much of the experience in excavation, embankment formation, puddle work, retaining wall and bridge construction, warehouse building and sluice making, which was available for the early railway builders.

The neglect of the canal system, as the result of the railway boom and Government indifference to the fate of the canals, followed by the depreciation of canal stocks, permitted the railway companies to initiate a policy of absorption as a preliminary to the destruction or suppression of their traffic competitor as far as practicable. No one can blame the railway companies; the Government alone was to blame. To-day the nemesis of the action of that day's Government is found in the supremacy of the railway companies over Parliament. Very different has been the policy of the Governments of France and Germany. Our commercial and industrial competitors have largely extended their canal systems, which have generally been maintained in a high state of working efficiency.

The ratio of canal absorption by the railways is about one-third of the total length. The number of canal navigations that have been under railway control is fifty-four, with a length of 1,205 miles. The canal navigations outside railway control are eighty-nine in number, with a length of 2,609 miles, many miles of which are now temporarily useless through neglect. The main arguments advanced by the railway companies to support their policy of canal absorption were to the effect that such a control would enable them to promote economy, and to reduce their freight rates. As a matter of fact, the removal of the waterway rival has enabled the railway companies to advance rather than reduce their rates.

The map which the author has prepared, page 504, shows very clearly the extent of breaking up by the railway policy of canal control. Very little through-canal traffic can be maintained without the goodwill and consent of the railway companies. That this policy of suppression of our inland navigable waterways has only been too effective is a painful fact. Hundreds of miles of our canals are little better than elongated ditches of mud or stagnant water, and it

is now impossible to trace many miles of canals for which Acts were obtained, and which were eventually made. How different is the case abroad. The United States of America has, according to one authority, 20,000 miles of inland navigable waterways; Germany has 16,000 miles, and France has length of navigable waterways as follows: 6,000 miles. The Almanack Hachette gives: the Canals, 4,930 kilometres; navigable rivers, 8,325 kilometres. Germany has 2,530 kilometres of canals.

TRANSFORMATION OF CANALS INTO RAILWAYS.

The suggestion has recently been repeated that our canals should be converted into railways. Although for short straight lengths this has been done in a few instances, it is obvious that, as canal routes follow level contours with lock methods of elevation as distinct from the gradients of railways, their transformation would be very difficult if not impracticable. It would be better, if such a retrograde step is ever found to be worthy of application, to transform the canals into motor or carways, as has been suggested by the author. Such a transformation might be applied to feeder canals, to permit motor wagons to act as distributors and collectors for canal services, for which they would be very efficient. The argument that railway companies would lower their rates to make canal competition impossible is a *reductio ad absurdum*.

Fig. 3 shows at a glance that canal transport costs are below possible railway competition in England. Besides if such a canal revivification by the State brought down railway rates, traders and the public generally would consider the national expenditure on the canal revivification to be well justified, even by its effect in securing a railway freight reduction.

The Worcester Chamber of Commerce has formulated a scheme for a canal trust, that shall control the operations and improve the character of the following group of canals: The Thames and Severn; the Upper and Lower Avon; the Wilts and Berks; the Stratford-on-Avon; the Stourbridge and Birmingham; the Somerset, Worcestershire and Birmingham; the Shropshire, Gloucester, Berkeley and Stroud.

ADVANTAGES OF A CANAL SYSTEM.

The capital cost of a canal is a mere fraction of that of a railway. The cost of making English canals is fairly represented by the figures of £3,500 per mile. Against this the cost of railways per mile of formation looks seriously formidable if represented by the figure

Freight Carried	System	Notes
1 ton miles per annum	BRITISH RAIL	
1 ton miles per annum	FRANCO RAIL	
2 ton miles per annum	EUROPEAN RAIL	
4 ton miles per annum	AMERICAN RAIL	
7 ton miles per annum	DUKE OF BRUNSWICK CANAL	
19 ton miles per annum	DUKE OF BRUNSWICK CANAL	
24 ton miles per annum	DUKE OF BRUNSWICK CANAL	

FIG. 3.
COMPARATIVE COSTS OF TRANSPORT.

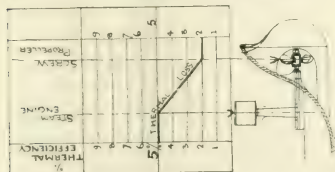


FIG. 2.
THERMAL EFFICIENCY.

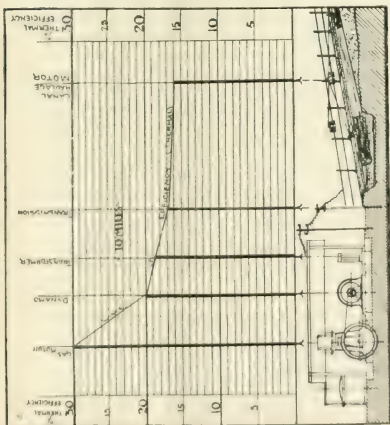


FIG. 1.

of £46,000 per mile. The capital amount actually paid up per mile of English and Welsh canals is said to equal £8,472. The capital invested in British railways is said to be equal to £52,370 per mile. The cost of transport on canals by horse haulage and electric methods is shown graphically by figs. 1, 2, and 3. The figures representing horse canal traction costs were supplied by the expert of a large and independent canal company. The items making up the cost of electric transport have been carefully determined.

Figs. 1 and 2 show the comparison between the thermal expenditure of a canal electrification system and that associated with a steam tug. In this latter system the energy absorbed in overcoming the skin resistance of the tug is neglected. A thermal efficiency of 5 per cent. is assumed for the engine with a screw propeller efficiency of 40 per cent.

The author has dealt with the causes of the decadence, and he has suggested that the State should confiscate the canals or absorb them by compulsory purchase at a fair valuation. It is obvious that unless this is done it is useless to discuss very closely any mechanical or other methods of reviving the general usefulness of our canals.

PROPOSED METHOD OF WORKING.

Circumstances put out of court all systems of electrification that involve the employment of screw propellers with aerial methods of electrification or otherwise, and electrically propelled locomotives travelling on the tow-path that rely on their own weight for the necessary adhesion qualifications.

The method that has been admitted by the practical canal experts of this country (and for which the author and Mr. George Cawley, M.E., are jointly responsible), consists in the employment of an electric horse, so the motor is called, that travels on light superposed steel rails carried by vertical standards erected at intervals along the extreme boundary of the canal tow path. The wheels of this electric horse grip on the steel rail providing the adhesion necessary to secure the haulage of the boat, the grip of the motor being directly proportionate to the tension on the tow-rope. One rail permits the electric horse to draw its boat in one direction, and another, super-elevated, permits its electric horse and without fear of entanglement of the two ropes, to draw its burden in the contrary direction.

This system therefore provides a practical electrical canal haulage solution which is suitable to the peculiar conditions of English canals, and which permits the highest thermal economy to be obtained. Elaborate tests made in a German canal with an electric haulage

system, apparently a modification by Ganz of the Thwaite-Cawley system, gave a 68 per cent. efficiency of haulage effort. The locomotive has a haulage capacity of 37½ h.p. and is capable of hauling barges of 600 tons burden. The average working cost per kilo mile is stated to be equal to 0·05 penny with current at 1½ penny per kilowatt. The cost of a kilowatt would in England be less than this.

Of course the electrical energy would, for trunk canals, be transmitted at high pressure and transformed to lower pressures for distribution. Gas power generating stations would be located every 20 miles in the length of the canal. The tow-paths would provide the way-leaves for laying the high-pressure conductors, which could serve for a general supply at cheap rates to all the areas (already unattached) through which the canal traverses. The locks, gates and sluices could be electrically actuated, and electric capstans would provide the necessary elasticity to the haulage system. The warehousing, hoisting and conveying machinery could also be electrically actuated, and there would be the obvious advantages of a cheap and abundant supply of electric energy for canal, dock and warehouse electric illumination and other services.

Electric energy is being successfully applied to actuate both canal, lock and sluice gates on Canadian canals, and swing cross-canal bridges are also being electrically rotated. The canals are being electrically illuminated; in one of them, the Soulanges Canal, alternate arc lights of 2000 c. p. are placed high over the canal tow-path, at distances of 160 yards, allowing night operations to be carried on.

ESTIMATED COST OF REORGANISATION.

The following is an estimate of the cost of nationalising, perfecting, and electrifying our canal system. Assuming that 3,500 miles of the canal system of Great Britain were purchasable at two-thirds of their original cost of construction, say £2,350 per mile of length, then the capital required would be £8,225,000. Allowing £500 per mile for the cost of standardising the locks, and £2,000 per mile for the electrification of the canals, then the total amount required would be £16,975,000. Allowing the balance to make up 20 millions to be set aside for working capital, it should secure for the State a splendid transport property. Seeing that over 60 millions sterling have been expended in tramway systems in this country, and that over 300 millions sterling have been absorbed in municipal work, the Government could surely be permitted by the country to become like France and Germany, the owners of an efficient, electrified, navigable, inland water service.

The proposed electrification of our canal system would, moreover, provide a cheap supply of electric power for export service, as well as for pumping, irrigation, ploughing, churning, milling, and vegetable and flower growth. The revivification of our inland navigable waterway system would go far towards securing a revival of our agricultural prosperity.

TECHNICAL SOCIETY NOTES.

The major portion of Mr. Marconi's lecture at the Royal Institution on Friday last dealt with familiar matter, which, in view of the scanty provision made for the press, was perhaps just as well. The magnetic detector which succeeded the coherer, and possesses a sensitiveness far beyond that of the best coherers, is no longer new, but Mr. Marconi referred to a development in connection with this detector which marks the latest advance in the domain of wireless telegraphy. The magnetic detector, as readers are aware, is capable of responding to signals at a very high rate of speed, up to some hundreds of words per minute, but it has not up to the present time been possible to work a recording instrument in conjunction with it, and much of the advantage of the speed of the detector was lost by reason of the fact that the signals received had to be read by sound.

Mr. Marconi is going to change all that. He told his audience on Friday last that he had succeeded in constructing a magnetic receiver that will work a relay and recorder, and work at a speed of some hundreds of words per minute. The advantages to wireless telegraphy of such a step in advance are obvious enough, as apart from the all-important gain in speed, the system is stated to be more simple, and to be absolutely reliable. The new receiver is stated to have been satisfactorily tested over a distance of 152 miles. Reference was made by Mr. Marconi to the effect of bright sunlight in retarding the distance over which wireless messages can be sent, but the impression that atmospheric conditions have any effect upon the speed of transmission is incorrect.

There was an interesting discussion at the Institution of Electrical Engineers on Thursday last, the subject being Mr. Donald Murray's paper on "Setting Type by Telegraph." Mr. Murray, who gave a demonstration of the apparatus, pointed out that invention in this field was outside the electrical field, the reason being that the problem to

be solved involved mechanical and not electrical difficulties, the electrical part of the whole thing being of exceedingly simple character. Mr. Murray is still, of course, improving his ingenious invention, and in particular he referred to possible improvements in the feed to the printer.

It was fitting that Mr. John Gavey, the engineer-in-chief to the Post Office, should open the discussion, as his department is giving a prolonged trial to the Murray apparatus. Mr. Gavey pointed out that in spite of the plethora of printing telegraphs which had been invented, the Morse system still held its ground for the major part of the telegraphic business transmitted, the reason being that the Morse alphabet was an ideal one for manual transmission. The system was costly, but quadruplex working had overcome some of the difficulties. Machine telegraphy was, however, a necessity for the transmission of press matter.

The Post Office have, it will be remembered, experimented with various machine systems, including the Rowland, the Pollak-Virag, the Mercadier, the Cried, and the Buckingham, in addition to the Murray. The Wheatstone system, as telegraph engineers are aware, is quite satisfactory as far as transmission is concerned; the faults are at the receiving end, and Mr. Gavey looks to the modern development of telegraphic instruments not only for the improved distribution of news matter, but for ordinary public messages. He hoped the Murray system would fulfil its promise of scientific working. What had impressed him most in Mr. Murray's invention was the ingenious method devised of securing synchronism.

Mr. W. Judd enlarged on the subject of alphabets, and warned all whom it might concern of the impossibility in a large telegraphic system of tampering with the alphabet. With cable messages the need for maintaining the running numbers constituted the difficulty. The question of the keyboard perforations was extremely interesting, indeed, his company was experimenting and would have one in operation in a short time. Synchronism, which in the old days had its terrors, now seemed fairly a simple problem and the cable companies were using it. It was quite true, as Mr. Murray had said, that invention in this field seemed to come from outside and the telegraph industry had benefited thereby. Mr. Higgins thought that for long distance telegraphy

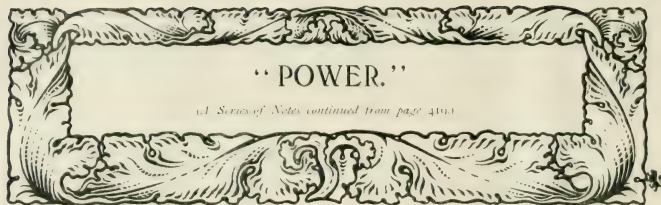
the Murray system might prove of considerable service, and indeed ultimately displace Wheatstone working. Mr. Mudford, who had himself been interested in a telegraphic type setting machine, gave Mr. Murray a few practical hints.

Mr. Murray, in his reply, said that if the speed of a printing telegraph was no greater than could be achieved by the Morse system, printing telegraphy would be doomed. There was, however, a good margin between the keyboard perforation and the Morse key in favour of the former. There was no competition between quadruplex working referred to by Mr. Gavey and the printing telegraph. He thought it would be possible to adapt the Murray machine to the Morse alphabet, and in that manner to meet the needs of the big cable companies with wide ramifications. The President wound up the discussion with a plea for a policy of development being adopted by telegraph engineers, who were sometimes conservative.

Reference was made during the discussion on "Overhead Mains," at the Institution of Electrical Engineers to the troubles likely to arise in connection with overhead wires which are carried along main roads. An interesting point in this connection arose at the conference of municipal tramway authorities held in London a few days ago. It was in relation to the protection of overhead trolley wires.

At the present time, when the Postmaster-General or the National Telephone Company desires to place an electric wire over those of a tramway, it becomes the duty of the tramway authority, whether a company or a municipality, to protect the live wire so that the telegraphs or telephone wire may not come in contact with it.

This, it was suggested, is throwing an unfair burden on the electric tramway interests, more particularly if the overhead equipment of the tramway should have been in position first. In such a case it might be fairly argued that the Post Office or the National Telephone Company should be charged with the duty of affording the necessary protection, and it has been decided to ask the Board of Trade to receive a deputation on this matter, and on the question of the construction of cars and other subjects in connection with the working and equipment of tramways.



LOCO-TYPE boilers for stationary purposes are made in such a large variety of sizes that average figures taken from the whole series would be of little value as a guide for designing or selecting one of any given capacity. I purpose, therefore, to embody in succeeding notes a set of rules deduced from a very large number of examples by leading makers, which may serve as a guide to the proportions of all sizes of loco-boilers. While embodying the results of the best practice in this class of boiler, as actually made, and in successful use in every country in the world to which British manufactures penetrate, I may remark that they do not represent the practice of any one firm in particular, but have been formulated specially as a standard series of loco-type boilers for stationary use.

One word, before proceeding to the consideration of these rules for the proportions of loco-type boilers. There is, perhaps, in the whole range of engineering nothing so elastic as the locomotive boiler, hence it must not be assumed that these rules offer anything more than a consistent series known from experience to give satisfactory results. That other boilers of different proportions also give satisfactory results is more than probable.

RULES FOR THE PROPORTIONS OF LOCO-TYPE BOILERS, GRATE-AREA BEING THE UNIT.

1. *Firebox Heating Surface* (when the grate-area is 8 square feet or less)—

Multiply the grate-area in square feet, minus 3, by 5·8, and add 14.

i.e. (if G = grate-area),

$$5\cdot8(G-3)+14.$$

2. *Firebox Heating Surface* (when the grate-area exceeds 8 square feet)—

Multiply the grate-area in square feet by 5·5.

i.e., 5·5 G .

3. *Tube Surface* (when the grate-area is 8 square feet or less)—

Multiply the grate-area in square feet, minus 3, by 29·2, and add 84.

i.e., 29·2($G-3$)+84.

4. *Tube Surface* (when the grate-area exceeds 8 square feet)—

Multiply the grate-area in feet by 25.

i.e., 25 G .

5. *Total Heating Surface* (Firebox and Tubes), (when the grate-area is 8 square feet or less)—

Multiply the grate-area in square feet, minus 3, by 35, and add 68.

i.e., 35($G-3$)+68.

6. *Total Heating Surface* (Firebox and Tubes) (when the grate-area exceeds 8 square feet)—

Multiply the grate-area in square feet by 30·5.

i.e., 30·5 G .

7. *Grate-area for Burning Wood* (instead of Coal)—

Multiply the grate-area in square feet by 1·2.

i.e., 1·2 G .

8. *Flue-way, or total Sectional Area of Tubes*, in square feet (no ferrules)—

Multiply the grate-area in square feet by 15.

i.e., 15 G .

9. *Number of Tubes* (Conditions as in Rule 11)—

(a) For 2½-in. tubes: Multiply the grate-area in square feet by 5·45.

(b) For 2¾-in. tubes: Multiply the grate-area in square feet by 4·4.

(c) For 3-in. tubes: Multiply the grate-area in square feet by 3·64.

(Taking the nearest whole number).

i.e., (a) 5·45 G ; (b) 4·4 G ; (c) 3·64 G .

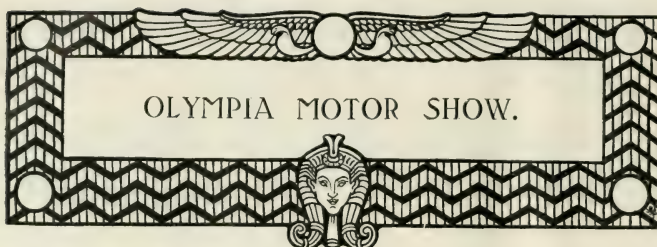
10. *Length of Tubes*, between tube-plates, in feet (conditions as in Rule 11)

(a) For 2½-in. tubes: Divide the tube-surface (Rules 3 or 4) by '6545 times the number of tubes (Rule 9).

(b) For 2¾-in. tubes: Divide the tube-surface (Rules 3 or 4) by '72 times the number of tubes (Rule 9).

(c) For 3-in. tubes: Divide the tube-surface (Rules 3 or 4) by '7854 times the number of tubes (Rule 9).

i.e. (a) $\frac{\text{Tube Surface}}{6545 \text{ (No. of Tubes)}}$ for 2½ in. tubes.



(Continued from page 462.)

WILLANS AND ROBINSON.

THE increasing interest which leading engineering firms are manifesting in the motor industry is, it need hardly be said, destined to prove of material advantage in the forthcoming development of what is still a new branch of manufacture, and the exhibit of this firm at Olympia, whose cylinders and other castings for motor-cars have attracted special attention, calls, therefore, for more than passing notice.



FIG. 1. PHOSPHOR BRONZE, UNTREATED.
MAGNIFIED 150 DIAMETERS.

Transverse section. A polished surface of the metal is first prepared, and the structure afterwards developed by treatment with nitric acid.

For some years Willans and Robinson have conducted a series of experiments upon varieties of vanadium steel. The outcome of these experiments has been the consistent production in commercial quantity of types of steel exceptionally suitable for use in motor-car construction.

The most exhaustive tests have been applied to these steels, and their behaviour under wide changes of temperature has also been fully studied. In addition, experience of their practical behaviour, gained on many tons, and over a period of upwards of a year, has been obtained. The results in detail of these investigations were recently submitted to the Institution of Mechanical Engineers by Captain Sankey, and Mr. Kent Smith, a lengthy abstract of which paper, with illustrations, was reproduced in *PAGE'S WEEKLY* for December 30th, 1904.

This firm is also introducing a new method of treatment for alloys for bearing purposes, an all-important one to all users of machinery, including automobilists. The results of experiments have yielded what may be fairly termed remarkable results, and the whole secret lies in the fact that the treatment entirely obviates the trouble due to the segregation of the different constituents of the alloys, and a practically complete equality in the structure of the mass of the bearing is obtained and a consequent equal distribution of the load spread over the wearing surface of the bearing, increasing its durability and anti-frictional properties to an extraordinary degree.

The most noticeable features to be observed in the bearings cast by this method are complete freedom from sponginess, perfect homogeneity, and increased density. The complete homogeneity ensures a wearing surface of perfectly mixed constituents of the alloy,

so that one does not find after a little while that the softer places have worn down and left the hard places raised up. There is instead a complete equal distribution of the load over the wearing surface. One point, by no means the least important, to be observed by automobilists and engineers, is the great decrease in power to drive any shaft running in bearings treated by this method as compared with ordinary bearings, thus considerably increasing the mechanical efficiency of the machine. These remarks apply in exactly the same way to white metal, phosphor bronze, gunmetal, and yellow brass. Even in white metal the tensile strength is increased some 50 per cent., and in phosphor bronze, gunmetal, and yellow brass, the increase in the tensile strength and elongation is most remarkable.

In figs. 1 and 2 are shown reproductions of micrographic sections, one No. 4,926, magnified 150 diameters, showing a casting in phosphor bronze cast in the ordinary way, and No. 4,927, showing a section of exactly the same material, but treated by the special method.

Another important point is the great resistance to crushing strains shown by all alloys cast by this method, which is remarkably evidenced in bearings for gas engine work. It is also shown that by this method less expensive alloys can be made to give results on bearings very superior to those at present obtained with more costly mixtures.



FIG. 2. PHOSPHOR BRONZE, TREATED.
MAGNIFIED 150 DIAMETERS.

Transverse Section.

WINTON MOTOR CARRIAGE COMPANY.

This company, which has its works at Cleveland, Ohio, sent an interesting exhibit to Olympia. The construction of the car is such as to give easy facilities for interchangeable bodies, and this feature was the subject of favourable comment. There are other points about the cars which give them distinction. One is

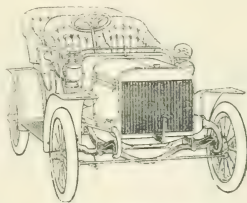


FIG. 3. WINTON MODEL.

the Winton spring, illustrated in fig. 6. It is of the semi-elliptic type, and as will be noted in the illustration, twin three-leaf springs are shackled together (at 198) and attached to the frame (at 199 and 202). With a light load the upper spring alone is in service. The lower spring is in reserve until the weight of the load increases to a point where the upper spring tends to straighten out. Then the lower spring comes into play, and, acting in company with the upper spring, forms a combination of sufficient resistance and resilience for any load likely to be carried. The prime advantage of this twin spring is that it combines, for varying loads, both resilience and resistance.

The oiling arrangement shown in fig. 5 displays ingenuity in design, and the principle is, we think, new in its application to motor cars. From the reservoir

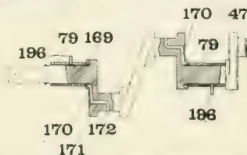


FIG. 4. SHOWING OIL SYSTEM FOR CRANKSHAFT.

above the cylinders, lubricating oil is fed by gravity to the automatic lubricator, being received in a float chamber, whereby a constant level is maintained and oil flow prevented when motor is not running. From this chamber oil passes into the main chamber

of the lubricator, where a gear-driven aluminum roller revolves in it. The viscosity of the oil being variable with the temperature, the thickness of the oil film on the roller would increase as the temperature decreased, resulting in an excess of oil at low temperature. To provide against this condition, an

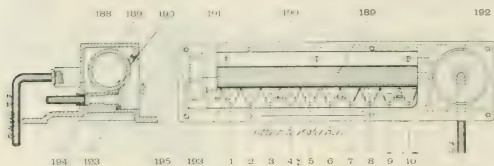


FIG. 5. WINTON OIL SYSTEM.

adjustable metallic scraper carries off the superfluous oil, limiting the thickness of the film to the distance between the scraper and the roller. Passing this scraper, the oil film engages a second scraper, in contact with the roller, by which it is directed in equal quantities through the ten oil leads extending to all the bearings of the motor and of the rear axle. This system of lubrication is designed to provide an oil feed in exact proportion to the motor speed. Cylinders 2, 4, 5, and 6 carry oil to the four-cylinder. The crankshaft and the connecting-rod bearings are lubricated by direct feed (fig. 4). The oil is carried by cylinders 7, 8, 9 and 10 from the oiler to the stationary bearings of the crankshaft bearing, lubricating the crank, and then passes through a groove to a channel which leads to the inside of each connecting-rod bearing.

A Winton car model is shown in fig. 3. The frame is of stamped steel, and no malleable castings are used, steel drop forgings being used for all parts. Every part is made to gauge, and identified by number or letter, and is therefore interchangeable.

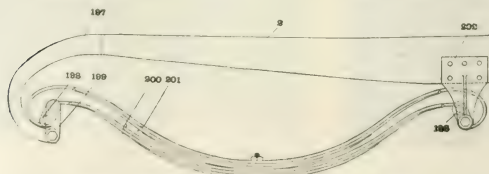


FIG. 6. WINTON SEMI-ELLIPTIC THREE-LEAF SPRING.

FOREIGN SHIPPING SUBSIDIES.

Mr. F. Shadforth Watts, the newly elected president of the Chamber of Shipping of the United Kingdom, in the course of his recent address to that body, said that during the past few months, orders for new tonnage

had been given out so freely that he was afraid the hoped-for revival in freights was not now even within measurable distance. On the question of foreign shipping subsidies, he said there was no doubt that sooner or later the United States Government would pass a Shipping Subsidy Bill calculated to cause a rapid increase in the mercantile tonnage under the

United States flag. He was told that the Bill now before Congress was not likely to pass this session; but, as an indication that early legislation might be expected, he thought it was significant that a contract for the carriage of coal from Norfolk to Manila was recently awarded to American shipowners on the basis of \$7 per ton by steam and \$6.50 per ton by sail, as against tenders at \$4.20 made by British ship owners. The inducement to add largely to the existing tonnage of the world afforded by means of Government subsidies was a great menace to the British shipping trade, but he was afraid that it was unlikely that mere representations to foreign Governments would have any effect unless and until His Majesty's Ministers were in a position to back up their representations by alternative retaliatory measures. The following resolution was subsequently passed on the motion of Mr. Herron: "That, in view of the bounties now granted by some foreign Governments to their ships, and of the legislation proposed in the United States of America, with the object of subsidising American

shipping at the expense of foreign shipping, this chamber desires to call the attention of His Majesty's Government to the disadvantages under which British shipping is placed, and requests that His Majesty's Government will take steps to obtain the withdrawal of existing bounties and prevent the granting of further bounties."

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

- Broadstairs.**—Construction, delivery, and erection at the above station of a horizontal tandem compound engine, condenser, well pumps, and all accessories. Mr. Percy Griffith, M. Inst. C.E., 54, Parliament Street S.W. ... Last Day
- Brighouse.**—Widening of the Calder Bridge, Brighouse, by means of steel lattice girders and steel stanchions for the Corporation. Mr. S. S. Haywood, Borough Engineer, Municipal Offices, Brighouse ... March 11
- Belgium.**—The "Bulletin Commercial" announces that the Belgian State Railways invite tenders for the installation of a set of ventilating and heating apparatus in the central workshops at Mechlin. Particulars of M. Slagmuylder, Engineer-in-chief, Station du Nord, Brussels ... March 13
- Park Royal.**—Supply, delivery, and erection of plant in connection with the electricity generating station at Park Royal and proposed sub-stations and distributing centres at various places, for the Great Western Railway Company. Messrs Kennedy and Jenkin, 17, Victoria Street, S.W. ... March 13
- Axbridge (Somerset).**—Supply of about 600 tons of cast-iron socket water-pipes 7-in. to 4-in in diameter, for Axbridge Union Rural District Council ... March 13
- Cromer.**—Supply and erection of a steam boiler for Urban District Council at new pumping station at Wetton. Mr. J. C. Melliss, M. Inst. C.E., Gresham House, Old Broad Street ... March 13
- South Shields.**—Supply, delivery and erection of the following plant in connection with the electricity supply department:—One multitubular marine type boiler, two medium-speed open-type vertical engines for two 550 k.w. direct current traction generators, two 500 k.w. direct current generators and traction switchboard. Mr. J. H. Cawthra, Borough Electrical Engineer ... March 13
- Llandyfodwg and Llantrisant (Wales).** The Glamorgan and Gwent Urban District Council invite tenders for two distinct and separate schemes of bridging the valley at Giffach, by extending Coronation-road, Evanstown, in the parish of Llandyfodwg, to join the highway known as Giffach-road, in the parish of Llantrisant. Mr. H. Dawkins Williams, Surveyor, Bryn Menin ... March 14
- Gloucester.**—Supply and erection of three Lancashire boilers and accessories, one 600 k.w. generator set and accessories, electrically-driven surface condensing plant, boiler feed pump, etc. Mr. J. Sheffield Blakey, Town Clerk ... March 14
- Liverpool.**—Construction of covered conduit about 1,100 yards in length, and other works connected therewith, situated in the townships of Withnell and Wheelton, in the county of Lancaster, for the Water Committee of the Liverpool Corporation. Mr. H. Dawkin Williams, Surveyor, Bryn Menin ... March 14
- London.**—Supply of electrical stores for year ending March 31, 1906, for the Fulham Borough Council. Town Clerk, Town Hall, Fulham ... March 15
- Peterborough.**—Supply and erection of the following plant, for the Corporation: (Section No. 1) Lancashire boilers, superheaters and economiser; (Section No. 2) triple expansion vertical engines, pumps, electric lighting set, travelling crane, workshop fittings, and tools; (Section No. 3) piping, injector, feed pump, tank, and feed-water softener. Mr. John C. Gill, Waterworks Engineer's Office, Peterborough ... March 15
- Welwyn.**—Supply and delivery of about 58 tons of 9-inch cast-iron pipes, for the Welwyn (Herts) Rural District Council. Messrs. Herbert Walker and Son, Albion Chambers, King Street, Nottingham ... March 27
- Grindleford and Rowsley.**—Construction of the Grindleford to Rowsley section of the Derwent aqueduct, in the county of Derby, for the Derwent Valley Water Board. Mr. Edward Sandeman, Engineer, Bamford, Sheffield ... March 27
- Bolton.**—Supply and erection of cooling tower and condensing apparatus in connection with power station, for the Electricity Committee. Mr. Arthur A. Day, borough electrical engineer, Spa Road, Bolton ... March 30
- Shanghai.**—The Shanghai Municipal Council invite tenders for the construction and operation of about 24 miles of electric tramways on the trolley system in the streets of the Settlement of Shanghai; alternative proposals are desired for the single-trolley and double-trolley lines. Council's agents, Messrs. John Pook and Co., 63, Leadenhall Street, London, E.C., and Messrs. Fearon Daniel and Co., 90, Wall Street, New York ... March 31
- Newport (Mon.).**—Construction of main outfall and branch sewers for the Western Valleys Sewerage Board. Particulars at offices of Mr. Baldwin-Latham, Parliament Mansions, Victoria Street, S.W.; Mr. Geo. Chatterton, 6, The Sanctuary, Westminster, S.W.; or Mr. T. S. Edwards, Clerk to the Board, Newport (Mon.) ... April

COMING CONTRACTS.

Stirling.—The Secretary for Scotland has sanctioned the borrowing of £41,000 for electric lighting extensions.

Crewe. A subcommittee has been appointed in connection with the borough surveyor's plans of a proposed new southern outfall-sewer and disposal works, which are estimated to cost £60,000.

Aylsham.—The provision of waterworks, estimated to cost £5,000, is under consideration.

Bath. The Council have adopted a report recommending the extension of the continuous-current generating plant at a cost of £3,000.

Wimbledon.—Application is to be made for sanction to borrow £13,218 for additional plant and extensions at the electricity works.

Plymouth.—An inquiry has been held into the Corporation's application for sanction to a further loan of £65,000 for the main drainage scheme.

South Shields.—The Council have under consideration the question of placing orders for motor omnibuses.

Ormskirk.—The Council have now adopted an electric lighting scheme, which includes the provision of a refuse destructor, and is estimated to cost £20,000.

CONTRACTS CLOSED.

Cape Town.—Cowans, Sheldon, and Co., of Carlisle have just completed the construction of a large crane, to be used in extending the harbour at Cape Town.

Lancaster.—The Lancaster Corporation have placed an order with the British Westinghouse Co. for two tramcars at £570 each.

Leith.—The Leith Tramways Reconstruction subcommittee have accepted the tender of M. P. Galloway, Ltd., for supply of tramway poles and accessories at £4,471.

Birkenhead.—The Power-Gas Corporation, Ltd., have been awarded a contract by the Tranmere Bay Development Company, Ltd., of Birkenhead, for a gas-driven electric installation for the latter company's new shipyard at Birkenhead.

Dartmouth.—A. and J. Main and Company, Ltd., of the Clydesdale Ironworks, Possilpark, Glasgow, are supplying the steel buildings complete for the new workshops for the Britannia Royal Naval College, Dartmouth.

Glasgow.—The Steel Company of Scotland, Ltd., Glasgow, have ordered from Mr. P. J. Mitchell, engineer, 52, Queen Victoria Street, E.C., a complete installation of Rateau patent exhaust accumulator regenerators, together with the necessary turbo-generating plant, condensers, cooling-tower, etc.

Manchester.—The Lancashire Electric Power Company, of Manchester, have contracted for the supply of current for the complete driving of the cotton-mill which is being built by the Acme Spinning Company, of Pendlebury. The mill will contain 41,000 mules and 34,000 ring spindles.

Stockport.—R. W. Blackwell and Co. are supplying the overhead equipment for the electrification of the Hazel Grove Route of the Stockport tramways for the sum of £4,343. The company's tender was the lowest, the next being that of the British Electric Company, at £4,683.

London.—The Brush Electrical Engineering Company, Ltd., have secured the following contracts: three 50 k.w. three-phase transformers for Sir W. G. Armstrong, Whitworth and Company; complete steam and electrical plant for power house for Leamington and Warwick tramways; three double-deck cars with radial trucks and Brush motor equipments for Airdrie and Coatbridge tramways.

APPOINTMENTS VACANT.

Last Day.

Tredegar.—Gas and water works' Engineer under Tredegar Urban District Council ... March 20

Llanelli.—General superintendent of harbour, docks, and railways under Llanelli harbour trustees. Salary, £300 per annum ... March 16

London.—The Corporation of London invite applications for the office of Engineer to the Public Health Department. Salary £1,000 per annum, rising to a maximum of £1,500 per annum. Candidates must be Members of the Institution of Civil Engineers. Associate Member of the Institution of Civil Engineers is not a sufficient qualification. Full particulars of the duties of the office and form of application may be obtained from the Town Clerk, Guildhall, E.C. ... March 18

Leeds.—Lecturer in Civil Engineering at the University. Salary, £300 per annum. The appointment to date from either April 1st, or October 1st. Particulars of Registrar at University ... March 25

Madras.—Assistant Engineer. The Madras Railway Company require an Assistant Engineer on an engagement for three years. Commencing salary, Rs. 350 per month. Apply: Secretary, Madras Railway Co., 1, Broad Street Place, E.C. ... March 18

Bombay.—The Bombay, Baroda, and Central India Railway Co. invite applications for appointment as chief draughtsman in the carriage and wagon department of the Company's service. Salary, Rs. 250, rising to Rs. 300 per month. Apply: Secretary, Gloucester House, Bishopsgate Street, E.C. ... March 22

APPOINTMENTS FILLED.

Rhodesia.—Mr. W. J. Hosgood, the engineer and locomotive superintendent of the Port Talbot Railway and Docks, South Wales, has been selected for the position of chief mechanical engineer of the Rhodesian Railways.

District Railway.—Charles A. King, permanent engineer of the Glasgow tramways, has been appointed to a similar position with the Metropolitan District Railway.

Johannesburg.—Mr. J. H. Dobson, formerly an apprentice in Crewe Railway Works, has been appointed to the Professorship of Electro-technics at the Transvaal Technical Institute, Johannesburg.

Ayr.—Mr. William Grant, tramway manager, Rotherham, has been appointed manager of the Ayr Corporation tramways. Mr. Grant has had twelve years' experience of tramway work under the Corporations of Blackpool, Darwen, and Rotherham.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as action requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: April 5th.

General Settlements: March 15th, 30th, April 13th.

Bank Rate, April 21st, 1904, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

ENGINEERING, IRON, AND STEEL COMPANIES.—Contd.

Unpaid Amount, Shareholder	Shares	Issued Part	Name	Paid up	Current Dividend	Amount Subscribed	Shares	Last Paid	Name	Paid up	Current Dividend
11,750	5	5	Alldays & Onions Pneumatic Engineering, Ltd.			750,000	1	63.	Howard & Bullock, Ltd., Ord.	1	14 1/2
10,000	5	3	Do. Cum. Pref. 6 per cent.	3	24 1/2	35,000	10	67.	Do. 6% Pref. (Non-Cum.)	10	124 1/2
3,210,000	1	2 1/2	Armstrong & Co., Ltd.	5	14 1/2	49,537	10	25.	Do. 4% Deb. Stk., Red after 1905	100	98 1/2
76,470	5	20	Do. 4% Cum. Pref.	5	52 1/2	30,000	1	44.	Lambert Bros., Ltd., Ord.	1	1 1/2
1,700,000	100	44	Do. 1st Mort. Dbs. Red	100	101 1/2	40,000	3	21 1/2	Do. 5% Cum. Pref.	3	4 1/2
1,000,000	100	44	Do. 1st Mort. Dbs. Red	100	96 1/2	200,000	1	71 1/2	Leeds Forge Co., 7% Cum. Pref.	3	3 1/2
50,000	1	1 1/2	Balcock and Wilcox, Ltd., Ord.	1	44 1/2	200,000	1	44.	Lyssagh (John), Ltd., 6% Cum. Pf.	100	101 1/2
100,000	1	7 1/2	Do. 6% Cum. Pref.	1	14 1/2	275,000	1	60.	Do. 4% 1st Mort. Dbs. Stk., Red	100	11 1/2
20,000	5	3	Baker (Joseph) & Sons, Ltd., 6% Cum. Pref.	5	5 1/2	21,943	5	2 1/2	Mather & Platt, Ltd., 5% Cum. Pref.	1	2 1/2
250,000	1	6 1/2	Baldwins, Ltd., 5% Cum. Pref.	1	1 1/2	11,218	5	5 1/2	Measures Bros., Ltd., Ord.	1	4 1/2
430,000	84 1/2	44	Do. 1st Mt. 4% Deb. Stk. Red.	100	101 1/2	6,000	62 1/2	47.	Do. 5% Cum. Pref.	1	4 1/2
150,000	44	3 1/2	Barrow Hematite Steel Co., Ltd., O	44	14 1/2	73,000	10	5/6	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
31,331	5	2 1/2	Bayless, James and Bayless, Ltd., 5% Cum. Pref. Shares	5	14 1/2	1,000	5	44 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	99 1/2
1,500,000	100	—	Beardmore, Nippon & Co., Ltd., 14% 1st Mt. Dbs., Red, Scrip 50% ps	—	102 1/2	1,000,000	5	2 1/2	Do. 6% Cum. Pref. "A"	5	5 1/2
50,000	10	6 1/2	Bell Brothers, Ltd., 6% Cum. Pref.	10	11 1/2	50,000	5	3/4	Do. 6% Cum. Pref. "B"	5	5 1/2
9,666,000	84 1/2	4	Do. 4% Deb. Stock, Red.	100	99 1/2	70,000	10	6/7	Pease & Partners, Ltd., Ord.	10	94 1/2
240,000	1	6 1/2	Boyer, J. & Sons, Ltd., Ltd., Ord.	1	14 1/2	84 1/2	4	44.	Do. 4% 1st Mort. Dbs. Stk.	100	97 1/2
1,000,000	84 1/2	4	Do. 5% Cum. Pref.	100	91 1/2	20,000	5	3/4	Peebles (Barne) & Co., Ltd., 6% C.M.P.	5	4 1/2
1,620,700	1	6 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	15,000	1	—	Pooley (Henry) & Son, Ltd., Ord.	1	6 1/2
1,500,000	1	3 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	15,000	1	—	Do. 5% Cum. Pref.	1	4 1/2
1,500,000	1	1 1/2	Brown (John) and Co., Ltd., Ord.	1	1 1/2	125,348	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
500,000	1	6 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	74,462	5	2 1/2	Rhymney Iron Co., Ltd.	5	14 1/2
71,000	10	5	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	350,000	1	7 1/2	Do. 5% Mort. Deb. Red.	100	100 1/2
154,500	5	2 1/2	Cammell, Laird & Co., Ltd., Ord.	5	2 1/2	2,000,000	84 1/2	44.	Richardsons, Warrington & Co., Ltd.	1	2 1/2
242,500	5	2 1/2	Do. 5% Cum. Pref.	5	2 1/2	3,000	10	12 1/2	Do. 4% 1st Mort. Dbs. Stk.	100	94 1/2
150,000	1	1 1/2	Clayton & Shuttleworth, Ltd., Ord.	1	1 1/2	275,000	1	84.	Ruston, Proctor & Co., Ltd.	10	94 1/2
70,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	300,000	1	7 1/2	Scott (Walter), Ltd., Ord.	1	1 1/2
100,000	10	5 1/2	Consett Iron Co., Ltd., Ord.	10	5 1/2	215,300	100	6 1/2	Do. 6% Cum. Pref.	1	1 1/2
27,000	10	10	Crosley, Bros., Ltd., Ord. 40840/3730	10	11 1/2	297,500	100	5%	Do. 4% 1st Mort. Dbs. Stk.	100	91 1/2
40,350	10	5	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	250,000	1	7 1/2	Shelton Iron, Steel and Coal Co., Ltd.	100	91 1/2
75,000	1	2 1/2	Dorman, Long & Co., Ltd.	1	2 1/2	300,000	1	1 1/2	Do. 6% 2nd Mort. Dbs., Red.	100	91 1/2
1,250,504	1	3 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	300,000	1	7 1/2	South Durham Steel & Iron, Ltd., Ord.	1	4 1/2
1,000,000	84 1/2	4	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	4 1/2	1,125,210	84 1/2	44.	Do. 6% Cum. Pref.	100	91 1/2
250,000	1	6 1/2	Dunlop (James) & Co., Ltd., Ord.	1	2 1/2	25,000	10	5%	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
300,000	1	6 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	275,000	10	5%	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
1,721	10	12 1/2	Ebbw Vale Steel, Iron & Coal Co., Ltd.	10	12 1/2	85,000	10	6 1/2	Stewarts & Lloyd, Ltd., Ord.	10	17 1/2
69,754	10	12 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	25,000	10	6 1/2	Swan, Hunter & Wigham	1	14 1/2
50,250	10	5	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	694,574	1	1,693	Richardson, Lim. Ord.	1	1 1/2
186,718	84 1/2	1	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	708,845	1	60.	Do. 5% Cum. Pref.	1	1 1/2
25,000	10	5	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	240,000	84 1/2	1 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
250,000	84 1/2	4	Fairfield Shipbuilding & Engineering Co., Ltd., 6% Mort. Deb. Stk. Red.	100	91 1/2	300,000	1	60.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	1 1/2
1,000	10	10	Fleming & Ferguson, Ltd., New 19000	10	12 1/2	200,000	100	4 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
5,000	10	5	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	1,000,000	1	7 1/2	Thornycroft (John) & Co., Ltd.	1	1 1/2
125,000	3	1 1/2	Fraser & Chalmers, Ltd., Ord.	3	1 1/2	10,000	10	5%	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
21,000	3	1 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	1,000,000	1	7 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
10,000	10	10	Galloway, Ltd., 5% Cum. Pref.	10	12 1/2	1,000,000	1	7 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
21,000,000	84 1/2	4	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	1,000,000	1	7 1/2	Vickers, Sons & Max., Ltd., Ord.	1	1 1/2
16,300	10	7	Greenwood & Batley, Ltd., Ord.	10	7 1/2	750,000	1	60.	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
9,000	10	7	Do. 7% Cum. Pref.	10	7 1/2	475,000	84 1/2	44.	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
965,000	1	1 1/2	Guest, Keen & Nelson, Ltd., Ltd.	1	1 1/2	21,250,000	84 1/2	44.	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
311,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	21,000,000	100	14 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
21,000,000	84 1/2	4	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	1,000,000	1	1 1/2	Wearside Steel, Coal & Coke, Ltd.	1	1 1/2
14,000	5	2 1/2	Gwynnes, Ltd., 5% Cum. Pref.	5	2 1/2	500,000	1	7 1/2	Do. 6% Cum. Pref. 1st Ord.	1	1 1/2
1,500,000	1	1 1/2	Hawthornthwaite, Ltd., Ltd., Ord.	1	1 1/2	4,000,000	84 1/2	44.	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
200,000	10	1 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	7,000	5	2 1/2	Weldless Steel Tube, Ltd., Cum. Pref.	5	4 1/2
400,000	5	3	Hall & Co., Ltd., 6% Cum. Pref.	5	3 1/2	7,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
400,000	5	3	Hawley & Co., Ltd., Ltd.	5	3 1/2	7,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
17,500	10	7	Hawthorn, Lang & Co., Ltd., Ord.	10	7 1/2	7,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
85,000	1	7 1/2	Head, Wroughton & Co., Ltd.	1	7 1/2	7,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
85,000	1	7 1/2	Hill, R. & Co., Ltd., 18900	1	7 1/2	7,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
18,000	5	3	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2	7,000	5	2 1/2	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2
30,000	10	6	Hornsby (Richard) & Sons, Ltd., Ord.	10	6 1/2	1,000,000	84 1/2	44.	Do. 4% 1st Mort. Dbs. Stk., Red.	100	91 1/2

Stocks and Shares quoted are prices as at close of business.

II.—ELECTRICAL MANUFACTURING COMPANIES.

ELECTRIC TRACTION.—Contd.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices	Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
70,000	1	6d.	Alliance Elec. Co. Ltd. 5% Cum. Pl.	1	2 1/2	£200,000	8tk	5%	Buenos Ayres Elec. Trans. Co. (1901) Ltd., 5% Deb. Stk., Red.	100	95 — 98
125,000	1	7 1/2d.	Aron Elec. Motor Ltd., 5% Cum. Pl.	1	18 1/2	£220,000	100	6%	Buenos Ayres Gd. Natl. Ltd., 6% 1st Deb. Bds.	100	103 — 106
120,000	1	9 1/2d.	Bell's Asbestos Co. Ltd., 5%	1	5 1/2	102,308	5	3/4	Calcutta Tramways Co. Ltd.	5	82 — 86
100,000	5	4	British Insulated & Helsby Cables Ltd., Ord.	5	53 — 64	£350,000	8tk	4%	Do. 4 1/2% 1st Deb. Stk., Red.	100	106 — 109
100,000	5	3 1/2	Do. 6% Cum. Pref.	5	54 — 52	480,000	1	2 1/2	Cape Electric Tramways, Ltd.	1	12 1/2 — 14
£200,000	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Rd.	100	101 — 104	40,000	5	6d.	City of Birmingham Trams Co. Ltd.	5	41 — 54
£200,000	Stk	4 1/2	British Thomson-Houston Co. Ltd., 4 1/2% 1st Mort. Deb. Stk. Red.	100	99 — 101 1/2	£300,000	100	4%	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	101 — 104
400,000	5	3 1/2	British Westinghouse Electric and Manufac. Co. Ltd., 5% Pref.	5	34 — 33	£120,000	8tk	5%	Colombo Elec. Tram. & Light. Co. Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 — 104
£616,353	Stk	4 1/2	Do. 4 1/2% Mort. Deb. Stk. Red.	100	80 — 91 1/2	60,000	10	6 1/2	Dublin United Trams Co. (1898), Ltd., Ord.	10	13 — 14
105,741	2	2 1/2	Brush Elec. Enging. Co. Ltd., Ord.	2	4 — 3	50,387	10	6 1/2	Do. 6% Pref.	10	164 — 164
£125,000	2	2 1/2	Do. 6% Pref.	2	14 — 12	30,000	5	2 1/2	Iale of Thanet Elec. Trams. and Light. Co. Ltd., 5% Cum. Pref.	5	3 — 3 1/2
£125,000	Stk	4 1/2	Do. 4 1/2% Perp. 1st Deb. Stk.	100	92 — 95 1/2	£150,000	8tk	4%	London United Trams. (1901), Ltd.	10	89 — 92
75,000	5	5 1/2	Callender's Cable Constn. Ltd. Ord.	5	11 — 11 1/2	125,000	10	6 1/2	Do. 5% Cum. Pref.	10	10 — 10 1/2
30,000	5	2 1/2	Do. 5% Cum. Pref.	5	54 — 52	£1,031,000	8tk	4%	Madras Electric Trams (1904), Ltd.	10	103 — 105
£250,000	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	105 — 107	£30,000	5tk	5%	5% Deb. Stock, Red.	100	101 — 103
85,000	3	1 1/2	Crompton & Co. Ltd., 5%	3	99 — 98	£1,016	1	—	Metropolitan Elec. Trams. Ltd., Def.	1	1 — 1
£100,000	—	5 1/2	Do. 5% 1st Mort. Deb. Reg. Bds.	100	92 — 94	£350,000	8tk	4 1/2	Do. 5% Cum. Pref.	100	105 — 107
52,000	5	10 1/2	Dick, Kerr & Co. Ltd., Ord.	5	59 — 64	50,000	5	6 1/2	New General Trac. Co. Ltd., 6% Cum. Pref.	5	4 — 14
61,000	5	3	Do. 6% Cum. Pref.	5	52 — 54	£196,200	8tk	5%	North Metropolitan Trams Co. Ltd.	10	90 — 95
£300,000	Stk	4 1/2	Do. 4 1/2% Deb. Stock, Red.	100	105 — 107	110,923	8	3 1/2	Perth Electric Trams, Ltd. (W.A.)	100	104 — 107
223,334	1	6d.	Doulton & Co. Ltd., 5% Cum. Pref.	1	14 — 14	£220,000	8tk	4 1/2	5% 1st Mort. Deb. Stock, Red.	100	104 — 107
£293,334	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	105 — 108	24,500	10	10 1/2	Potteries Elec. Trac. Co. Ltd., Ord.	10	94 — 94
99,351	5	1 1/2	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1,99,351	5	1 — 1	24,500	10	4 1/2	Do. 5% Cum. Pref.	10	102 — 105
17,439	5	2 1/2	Do. "A" Shares Nos. 01,017,139	5	1 — 14	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£444,023	Stk	4 1/2	Do. 4 1/2% Deb. Stock, Red.	100	77 — 82	24,500	10	10 1/2	Potteries Elec. Trac. Co. Ltd., Ord.	10	94 — 94
£100,000	Stk	5	Do. 5% Second Deb. Stk. Red.	100	81 — 86	£220,000	8tk	4 1/2	Do. 4 1/2% Cum. Pref.	10	104 — 105
112,100	2	1 1/2	Electric Construction Co. Ltd., 2	2	14 — 14	24,500	10	10 1/2	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
31,300	2	7 1/2	Do. 7% Cumulative Pref.	2	24 — 23	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£200,000	Stk	4 1/2	Do. 4 1/2% Perp. 1st Mort. Deb. Stk.	100	97 — 99	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
10,248	10	7 1/2	Evered and Co. Ltd., 10	10	13 — 15	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£100,000	Stk	5 1/2	Ferranti, Ltd., 5% 1st Mort. Deb. Stk. Red.	100	90 — 95	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
25,000	10	5	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	94 — 10	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£300,000	Stk	4%	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	91 — 96	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
35,000	5	6 1/2	Henley's (W. T.) Telegraph Works Co. Ltd., Ord.	5	13 — 13 1/2	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
85,000	5	2 1/2	Do. 4 1/2% Cum. Pref.	5	58 — 54	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£50,000	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	100 — 111 1/2	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
50,000	10	6 1/2	India Rubber, Gutta Percha & Telegraph Works Co. Ltd., 10	10	16 — 17	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£300,000	100	4%	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	100 — 103	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
7,500	10	4%	Parker, Thos. Ltd., 10	10	64 — 7	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
100,000	1	3 1/2	Scott, Ernest & Mountain, Ltd., Ord.	1	16 1/2 — 16 1/2	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
37,350	12	12 1/2	Telegraph Construction and Maintenance Co., Ltd.	12	35 — 37	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105
£150,000	100	1	Do. 4 1/2% Deb. Bonds	100	102 — 104	£200,000	8tk	4%	Do. 4 1/2% Deb. Stk. Red.	100	104 — 105

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices	Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
85,000	5	2 1/2	Do. 4 1/2% Cum. Pref.	5	58 — 54	7,500	10	16 1/2	Bournemouth & Poole Elec. Sup. Co. Ltd., Ord.	10	12 1/2 — 12 1/2
£50,000	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	100 — 111 1/2	7,500	10	4 1/2	Do. 4 1/2% Cum. Pref.	10	94 — 10
50,000	10	6 1/2	India Rubber, Gutta Percha & Telegraph Works Co. Ltd., 10	10	16 — 17	7,500	10	6 1/2	Do. 6% Cum. Second Pf.	10	11 — 12
£300,000	100	4%	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	100 — 103	7,500	10	4 1/2	Do. 4 1/2% Deb. Stock Red.	100	104 — 106
7,500	10	4%	Parker, Thos. Ltd., 10	10	64 — 7	14,000	5	2 1/2	Bromley (Kent) Elec. Lt. & Pr. Co. Ltd.	5	24 — 54
100,000	1	3 1/2	Scott, Ernest & Mountain, Ltd., Ord.	1	16 1/2 — 16 1/2	£50,000	Stk	4 1/2	Do. 4 1/2% 1st Deb. Stk. Red.	100	101 — 104
37,350	12	12 1/2	Telegraph Construction and Maintenance Co., Ltd.	12	35 — 37	27,507	5	4 1/2	Brompton & Kensington Elec. Supply Co., Ltd. Ord.	5	104 — 11
£150,000	100	1	Do. 4 1/2% Deb. Bonds	100	102 — 104	12,493	5	3 1/2	Do. 7% Cum. Pref. Shares	5	101 — 102
25,000	10	5	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	94 — 10	60,000	5	3 1/2	Calcutta Elec. Sup. Cor. Ltd., Ord.	5	9 — 9 1/2
£300,000	Stk	4%	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	91 — 96	£288,782	Stk	4 1/2	Central Elec. Sup. Co., Ltd., 4 1/2% Deb. Stk.	100	105 — 108
35,000	5	6 1/2	Henley's (W. T.) Telegraph Works Co. Ltd., Ord.	5	13 — 13 1/2	70,000	5	4 1/2	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	72 — 84 1/2
85,000	5	2 1/2	Do. 4 1/2% Cum. Pref.	5	58 — 54	80,000	5	2 1/2	Do. 4 1/2% Cum. Pref.	5	74 — 82 1/2
£50,000	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	100 — 111 1/2	£350,000	Stk	4 1/2	Do. 4 1/2% 1st Deb. Stk. Red.	100	102 — 104
50,000	10	6 1/2	India Rubber, Gutta Percha & Telegraph Works Co. Ltd., 10	10	16 — 17	41,436	5	8 1/2	Chelsea Elec. Sply. Co. Ltd., Ord.	5	62 — 71
£300,000	100	4%	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	100 — 103	£150,000	Stk	4 1/2	Do. 4 1/2% Deb. Stk. Red.	100	109 — 111
7,500	10	4%	Parker, Thos. Ltd., 10	10	64 — 7	10,000	10	4 1/2	City of London El. Lightg. Co. Ltd., O.	10	124 — 127
100,000	1	3 1/2	Scott, Ernest & Mountain, Ltd., Ord.	1	16 1/2 — 16 1/2	£100,000	Stk	4 1/2	Do. 6% Cum. Pref.	10	132 — 144
37,350	12	12 1/2	Telegraph Construction and Maintenance Co., Ltd.	12	35 — 37	£100,000	Stk	4 1/2	Do. 6% Deb. Stk. Red.	100	123 — 127
£150,000	100	1	Do. 4 1/2% Deb. Bonds	100	102 — 104	£100,000	Stk	4 1/2	Do. 4 1/2% 2nd Deb. Stk. Red.	100	103 — 105

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices	Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
120,000	5	3 1/2	Anglo-Argentine Trams Co., Ltd., Ord.	5	72 — 82	70,000	5	4 1/2	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	72 — 84 1/2
200,000	5	2 1/2	Do. 5% Cum. Pl.	5	52 — 51	80,000	5	2 1/2	Do. 4 1/2% Cum. Pref.	5	74 — 82 1/2
£200,000	Stk	6 1/2	6% Debenture Stock, 1888	100	140 — 113	£350,000	Stk	4 1/2	Do. 4 1/2% 1st Deb. Stk. Red.	100	102 — 104
20,000	10	6 1/2	Barcelona Trams Co., Ltd., Ord.	10	12 — 12 1/2	41,436	5	8 1/2	Chelsea Elec. Sply. Co. Ltd., Ord.	5	62 — 71
10,000	10	6 1/2	Do. 5% Cum. Pl. Shares	10	9 — 10	£150,000	Stk	4 1/2	Do. 4 1/2% Deb. Stk. Red.	100	109 — 111
440,000	100	2 1/2	Do. 6% Deb. Stk. Red.	100	99 — 102	10,000	10	4 1/2	City of London El. Lightg. Co. Ltd., O.	10	124 — 127
£191,225	Stk	4 1/2	Do. 4 1/2% Red. Deb. Stk.	100	96 — 100	£100,000	Stk	4 1/2	Do. 6% Cum. Pref.	10	132 — 144
75,000	1	11 1/2	Bath Elec. Trams, Ltd., Pl. Ord.	1	14 — 14 1/2	£100,000	Stk	4 1/2	Do. 6% Deb. Stk. Red.	100	123 — 127
79,294	1	11 1/2	Do. 5% Cum. Pl.	1	14 — 14 1/2	£100,000	Stk	4 1/2	Do. 4 1/2% 2nd Deb. Stk. Red.	100	103 — 105
7,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	14 — 14	£100,000	Stk	4 1/2	County of London Elec. Supply Co., Ltd., Ord.	10	94 — 10
70,000	5	2 1/2	Do. 5% Cum. Pl.	5	52 — 51	£100,000	Stk	4 1/2	Do. 6% Cum. Pref.	10	124 — 127
£125,000	Stk	4 1/2	Do. 4 1/2% 1st Deb. Stk. Red.	100	91 — 98	£100,000	Stk	4 1/2	Do. 4 1/2% Deb. Stk. Red.	100	109 — 112
£200,000	Stk	6 1/2	Brit. Colum. Elec. Tr. Co., Ltd., Def. Ord. Stock	100	103 — 106	£100,000	Stk	4 1/2	Edmundson Elec. Co., Ltd., Ord.	5	6 — 6 1/2
100,000	10	6 1/2	Brit. Electric Trac. Ltd., Ord.	10	34 — 37	£300,000	Stk	4 1/2	Do. 4 1/2% 1st Mort. Deb. Stk. Red.	100	106 — 108
100,000	10	6 1/2	Do. 5% Deb. Stk. Red.	100	102 — 104	£250,000	Stk	4 1/2	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
£1,000,000	Stk	5	Do. 5% Perp. Deb. Stk.	100	121 — 123 1/2	£100,000	Stk	4 1/2	Falkstone Elec. Supply Co. Ltd., O.	5	54 — 6
£200,000	Stk	4 1/2	Do. 4 1/2% 2nd Deb. Stk. Red.	100	97 — 99	£100,000	Stk	4 1/2	Do. 4 1/2% 1st Deb. Stk. Red.	100	101 — 103
100,000	5	1 1/2	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	31 — 4	£100,000	Stk	4 1/2	Hove Elec. Lightg. Co., Ltd., Ord.	5	74 — 8
10,000	5	3	Do. "A" 6% Cum. Pref.	5	30 — 54	£100,000	Stk	4 1/2	Iale of Thanet Elec. Trams. and Light. Co. Ltd., 5% Cum. Pref.	5	3 — 3 1/2
7,000	5	3	Do. "B" 6% Cum. Pref.	5	30 — 54	£100,000	Stk	4 1/2	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord.	5	12 1/2 — 13 1/2

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER. —Contd.

TELEGRAPHS AND TELEPHONES. —Contd.

Present Amount Subscribed	Shares	Last Paid	Name	Last Paid	Closing Prices
\$135,000	84k	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., Deb. Stock, Red.	100	102 1/4
111,000	3 1/2	10%	London Elec. Supply Corp., Ltd. Ord.	5	26 1/2
60,000	5	8%	Do. 6% Pref.	5	54 1/2
\$371,895	84k	4%	Do. 4 1/2 Mort. Deb. Stk., Red.	100	90-101
100,000	10	9%	Metropolitan Elec. Sup. Co., Ltd., Ord.	10	14 1/2-19 1/2
75,121	5	2 1/2	Do. 4 1/2 Mort. Deb. Stk., Red.	100	110-115
240,000	84k	4%	Do. 4 1/2 Mort. Deb. Stk., Red.	100	97-100
250,000	84k	3 1/2	Do. 3 1/2 Mort. Deb. Stk., Red.	100	97-100
\$250,000	100	10%	Midland Elec. Corp. for Power Distribution, Ltd., 1st Mort. Deb.	100	97-100
10,852	10	6%	Notting Hill Elec. Lig. Co. Ltd. Ord.	10	114-115
\$29,000	100	4%	Do. 4 1/2 Mort. Deb.	100	102-104
16,500	5	2 1/2	Oxford Electric Co. Ltd., Ord.	5	65-66 1/2
\$50,000	84k	4%	Do. 4 1/2 Mort. Deb. Stk., Red.	100	98-100
\$24,730	100	14%	Royal Elec. Co. (of Montreal) 4 1/2 Mort. Deb.	100	100-102
40,000	5	2 1/2	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	124-125 1/2
21,000	5	3 1/2	Do. 7% Pref.	5	81-82 1/2
\$150,000	84k	3%	Do. 3%, Deben. Stock, Red.	100	98-100
12,000	5	4%	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	32-34 1/2
\$50,000	84k	4%	Do. 4% Debenture Stk. Red.	100	70-83
65,000	5	3 1/2	South London Elec. Sup. Co., Ltd., Ord.	5	42-44 1/2
100,000	1	10%	South Metropolitan Elec. Light & Power Co., Ltd. Ord.	1	12-12 1/2
50,000	1	8 1/2	Do. 7 1/2 Cum. Pref.	1	12-12 1/2
\$100,000	84k	4%	Do. 4 1/2 1st Deb. Stock, Red.	100	107-110
50,000	5	2 1/2	Urban Electric Supply Co., Ltd., Ord.	5	54-56 1/2
31,000	5	2 1/2	Do. 4 1/2 Mort. Deb. Stk., Red.	100	106-108
\$200,200	84k	4%	Westminster Elec. Supply Corp., Ltd., Ord.	5	122-131 1/2
110,000	5	7%	Do. 5% Cum. Pref.	5	64-65 1/2

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Paid	Name	Last Paid	Closing Prices
\$22,500	10	5 1/2	Anchor Line (Henderson Bros.), Ltd., 5 1/2 Cum. Pref.	10	84-9
\$32,000	84k	4%	Do. 4 1/2 1st Mort. Deb. Stk.	100	99-101
\$67,200	8 1/2	4%	British & African Steam Navigation Co., Ltd., 1st Mort. Deb. Stk., Red.	100	93-95
10,000	10	5 1/2	Bucknall Steamship Lines, Ltd., Do. 4 1/2 1st Mort. Deb. Stk., Red.	100	74-77
\$200,000	84k	4%	Cian Line Steamers, Ltd., 4 1/2 Deb. Stk., Red.	100	74-77
60,000	20	16 1/2	Cunard Steam Ship Co., Ltd., No. 1,500,000, 100	100	134-14
40,000	20	8%	Do. No. 60,001-100,000, 100	100	134-14
\$191,440	84k	4%	Elder Dempster Shipping, Ltd., 4 1/2 1st Mort. Deb. Stk.	100	101-103
1,200,000	1	6 1/2	Furness, Withy & Co., Ltd., Ord.	1	14-15 1/2
1,750,000	84k	4%	Gen. Steam Navigation Co., Ltd., Ord.	7 1/2	42-44
36,758	8	4 1/2	Do. Non-Cum. 6% Pref.	8	74-8
\$150,000	84k	4%	Do. 4 1/2 1st Mort. Deb. Stk., Red.	100	99-101
35,000	5	1 1/2	Houlder Line, Ltd., Ord.	5	24-3
40,000	5	2 1/2	Do. 5 1/2 Cum. Pref.	5	34-36
\$200,000	84k	4%	Do. 4 1/2 1st Mort. Deb. Stk., Red.	100	83-86
141,500	10	5 1/2	Leyland (Frederick) & Co. (1900), Ltd., Cum. Pref.	10	54-56
\$1,160,000	84k	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref.	100	131-131 1/2
\$1,160,000	84k	19%	Do. 19% Cum. Pref.	100	131-131 1/2
15,000	100	30	Royal Mail Steam Packet Co. Ord.	60	234-254
30,075	5	2 1/2	Shaw, Savill & Albion, Ltd., 5%	5	44-54
111,441	10	4 1/2	Cum. "A" Pref.	5	44-54
21,000	10	4 1/2	Union Castle Mail Steamship Co., Ltd., Ord.	10	84-86
\$1,088,251	84k	4%	Do. 4 1/2 Cum. Pref.	100	94-104
			Do. 4 1/2 Debenture Stk., Red.	100	94-104

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Paid	Name	Last Paid	Closing Prices
\$4,400	100	4%	African Direct Tel. Co., Ltd., 4 1/2 Mt. Deb. Stk., Red.	100	99-102
25,000	10	10%	Amazon Telegraph Co., Ltd., Ord.	10	34-36
\$763,500	84k	17 1/2	Anglo-American Tel. Co., Ltd., Ord.	100	69-72 1/2
\$3,118,210	84k	17 1/2	Do. 6% Preferred Ordinary	100	67-70 1/2
\$3,118,210	84k	17 1/2	Do. Deferred Ordinary	100	134-154
11,000	5	3	Chill Telephone Co., Ltd.	5	62-65
\$15,000,000	\$100	52	Commercial Cable Co., Capital Stk.	\$100	230-240
\$1,903,856	84k	1	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97-100
10,000	10	5	Cuba Submarine Tel. Co., Ltd., Ord.	10	27-34
6,000	10	10%	Do. 10% Preference	10	17-18
6,000	2	2	Direct Spanish Telegraph Co., Ord.	2	32-34
\$30,000	50	14 1/2	Do. 4 1/2 Deb. Stk.	50	100-104 1/2
60,710	20	3	Direct U.S. Cable Co., Ltd.	20	11-11 1/2
\$85,800	100	14	Direct West India Cable Co., Ltd., 4 1/2 Reg. Deb.	100	90-101
\$330,000	100	4	East & S. African Tel. Ld., 4 1/2 Mt. Deb.	100	100-102
\$200,000	25	4	Do. 1 1/2 Reg. Mt. Deb. Subsidy	25	101-103 1/2
300,000	10	2 1/2	Eastern Extension, Australian and New Zealand, Ltd., 1st Mort. Deb. Stk., Red.	100	10-14 1/2
\$602,400	84k	1	Do. 1 1/2 Mort. Deb. Stk., Red.	100	104-106
\$1,000,000	84k	25	Eastern Tele. Co., Ltd., Ord.	100	143-146
\$2,000,000	84k	17 1/2	Do. 3% Pref.	100	90-92 1/2
\$1,936,814	10	5	Do. 5% Mort. Deb. Stk., Red.	100	105-108
150,000	10	5	Great Northern Telegraph Co., Ltd., (of Copenhagen)	10	32-34
\$58,700	100	4 1/2	Hallifax and Bermudas Cable Co., Ltd., 4 1/2 1st Mort. Deb. Stk., Red.	100	100-102
17,000	25	12 1/2	Indo-European Tele. Co., Ltd.	25	40-42
72,680	1	7 1/2	Monte Video Telephone Co., Ltd., Ord.	1	42-44
\$1,984,443	84k	6	National Telephone Co., Ltd., Pref.	100	113-114 1/2
\$1,984,443	84k	6	Do. 6% Non-Cum. 1st Pref.	100	106-108
\$20,000	84k	3 1/2	Do. 3 1/2 Deb. Stk., Red.	100	98-100
\$200,000	84k	3 1/2	Do. 4 1/2 Mort. Deb. Stk., Red.	100	104-106
\$179,313	1	7 1/2	Oriental Telephone Co., Ltd., Ord.	1	11-12
60,000	1	7 1/2	Do. 6% Cum. Pref.	1	12-14
\$100,000	100	14 1/2	Reuter's Telegram Co., Ltd., Ord.	100	98-101
11,829	8	4 1/2	Do. 4 1/2 Deb. Stk., Red.	8	2-3 1/2
58,000	5	3 1/2	United River Plate Tele. Co., Ltd., Ord.	5	24-26
40,000	5	2 1/2	Do. 5% Cum. Pref.	5	34-36
\$179,917	84k	3 1/2	Do. 4 1/2 Deb. Stk., Red.	100	105-108
10,000	10	10%	W. African Telegraph Co., Ltd., Ord.	10	40-42
\$30,000	24	4	West Coast of America, Ltd.	24	100-102
150,000	100	14	Do. 1 1/2 Deb. Wagon, by West. Ltd.	100	100-102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Paid	Name	Last Paid	Closing Prices
60,000	1	950	Chadburn's (Ship) Tele. Ltd., Ord.	1	8-14
\$750,000	84k	5	General Hydraulic Power Co., Ltd.	100	104-108
12,500	10	10	Oakey (John) and Sons, Ltd., Ord.	10	24-26
10,000	10	6	Do. 6% Cum. Pref.	10	14-15
\$84,488	1	6 1/2	Power Gas Corp., Ltd., Ord., Nos. 1,001-250	150	30-35
66,462	1	8 1/2	Do. Nos. 1,001-250	1	26-30
135,000	1	6 1/2	Waygood (R. & Co.), Ltd., Ord.	1	14-16 1/2
135,000	1	7 1/2	Do. 6% Cum. Pref.	1	14-16 1/2

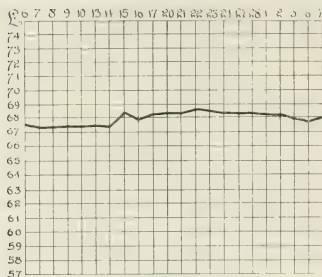
RAILWAY CARRIAGE & WAGON COMPANIES.

Present Amount Subscribed	Shares	Last Paid	Name	Last Paid	Closing Prices
10,000	10	7 1/2	Barns Railway Car & Wagon, Ltd., 1-10,000	10	21-25 1/2
8,739	10	6 1/2	Do. Second Issue 1-10,000	1	8-9 1/2
10,000	10	6 1/2	Do. Cum. Pref. 1-10,000	10	14-16 1/2
\$3,111	2	7 1/2	Bromfield Rail. Car & Wagon, Ltd.	7	9-10
41,880	7	3 1/2	Do. A, 1-20,000 & B, 20,001-75,000	7	1-14
11,967	10	1 1/2	Doncaster Railway Wagon, Ltd.	10	10-12
79,788	1	9 1/2	Metropolitan Amalgamated Rail. Carriage & Wagon, Ltd., 1-1,000	1	11 1/2-12 1/2
161,288	1	6 1/2	Do. Cum. A Pref. 1-1,000	1	11 1/2-12 1/2
25,000	1	5 1/2	Do. Cum. B Pref. 1-1,000	1	11 1/2-12 1/2
25,000	20	20	Metropolitan Rail. Car & Wagon, Ltd.	10	19-20 1/2

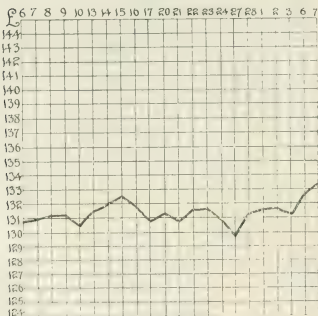
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM FEBRUARY 6TH TO MARCH 7TH, 1905.

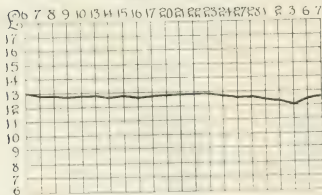
COPPER.



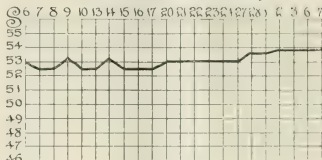
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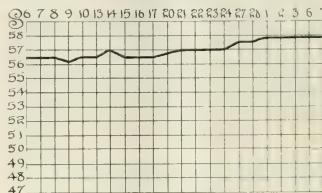
ENGLISH LEAD.



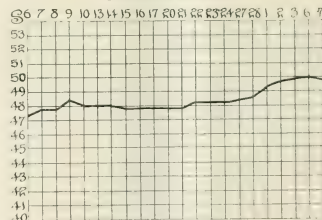
PIG IRON: SCOTCH,



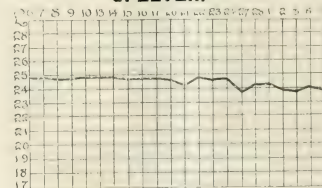
HEMATITE,



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, March 8th, 1905.

THE home Copper market has been somewhat inactive during the past week, notwithstanding satisfactory American advices. However, the demand for refined copper remains on a fairly satisfactory scale, and stocks in consumers' hands are very low, a significant feature being the call for immediate delivery. The latest turn in the market is towards a partial recovery, the closing prices yesterday being cash £63 2s. 6d. and three months £68 7s. 6d.

Dealings in Tin have been on a large scale. The statistics published at the end of the month were exceedingly satisfactory, there being a decrease of 3,145 tons in the total visible supplies in Europe, although stocks in the United States are said to be about 1,800 tons higher. Some excitement has been created in the market by the announcement that the Dutch sales, for the remainder of the year, would be curtailed, and the market has risen sharply to £133 15s. cash, and £132 10s. three months.

Holders of Lead have again been obliged to make sacrificing sales, as low as £12 being accepted for prompt delivery, and the quotation remains about this figure, closing prices being £12 foreign, and £12 5s. English.

In the Iron and Steel section very strong advices from the United States have dominated the situation. The output of pig-iron and the demand for it are said to be unprecedented, and there are all the makings of a genuine boom about the present position. The market for Cleveland warrants has been very strong, the aggregate business totalling about 90,000 tons, and quotations show an important rise, large buying orders from consumers and speculators being accompanied by bear covering. Merton and Co's circular points out that makers of Cleveland iron are well sold owing to their large deliveries into public stores, and the same authority is responsible for the statement that the position has in it elements of sensationalism, and that the current production in the United States, notwithstanding that it is the largest on record, will be insufficient to meet the country's requirements.

A sharp reaction in Spelter brought the price down to £23 15s., but a steadier tendency is now noticeable and consumers are now buying more readily.

IRON, STEEL, PIG- IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:	£	s.	d.
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
" " " Land	6	17	6
" " " Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
" " " Ship	6	7	6
" " " Angles	5	7	6

Manufactured Iron:

Bars—Dalzell	6	2	6
" Best	6	12	6
" Horseshoe	6	12	6
" Angle	6	2	6
" Best Angle	6	12	6
" Best Best	7	2	6
" Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.
Steel Angles (Glasgow  Steel)	5	7	6 per ton.
Steel Ship Plates (Glasgow  Steel)	5	17	6
Steel Bars, Ship Quality (Glasgow  Steel)	6	7	6
Steel Bars, Boiler Quality (Glasgow   Steel)	6	17	6
Steel Land Boiler Plates (Glasgow   Steel)	6	7	6
Steel Marine Boiler Plates (Glasgow   Steel)	6	7	6

Less 5 per cent discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phoenix Iron-works, Coatbridge, N.B., quotes:—

Bars—Phoenix	£	s.	d.
Best	6	5	0
Best Best	6	15	0
Extra Best	7	5	0
Extra Best	7	15	0
Best Horseshoe	6	15	0
Extra B.H.S.	7	15	0
Extra Best Cable ..	8	5	0
Best	6	5	0
Best Scrap Rivet ..	7	5	0

Angles—Phoenix	£ s. d.
Best	6 5 0
Extra Best	6 15 0
Gas Tube Hoops—Phoenix Best	6 15 0
Plates—Phoenix	—
Best Boiler	7 10 0
Best Best Boiler	8 0 0
Extra Best Boiler	9 0 0
Boiler Tube Strips—Phoenix Best Best	8 0 0

All per ton, delivered f.a.s. Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1.	No. 3.
	£ s. d.	£ s. d.
Coltness, f.a.s. Glasgow	3 4 6	2 14 0
Gartsherrie	2 19 0	2 14 0
Summerlee	2 19 0	2 14 0
Carnbroe	2 16 6	2 12 6
Langloan	3 4 0	2 15 0
Calder	2 19 0	—
Clyde	2 18 6	2 13 6
Glengarnock, f.o.b. Ardrossan	2 18 0	2 12 6
Eglington	2 14 6	2 12 6
Dalmellington, „ Ayr	2 14 6	2 12 6
Shotts „ Leith	2 19 0	2 14 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, at works:—

	£ s. d.
W.W.  Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby 	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W.  Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
TEE Iron, to 8 inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron.	Steel.
	£ s. d.	£ s. d.
 Bars	6 10 0	7 5 0
(BF) Angles	7 0 0	7 5 0
Tees	7 10 0	7 15 0
 Hoops	7 0 0	7 10 0
W.I.W. Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowthor, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G. to 24 G. by 36in. per ton.	Doubles 21 G. to 24 G. 36in. by 36in. per ton.
	£ s. d.	£ s. d.
Black Sheets:		
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Seyern"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

	Singles 20 G. to 108 by 36in. per ton.	Doubles 21 to 24 G. to 96 by 36in. per ton.
	£ s. d.	£ s. d.

Tinned Sheets:

	£ s. d.	£ s. d.
Best Coke (Finish)	28 0 0	29 10 0
Charcoal (Finish)	30 0 0	31 10 0
Extra	32 0 0	33 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for. Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box. Extreme sizes in Tin and Patent Coated specially quoted for. Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands. At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£ s. d.
"Phoenix" Brand, 24 G., f.o.b. London, in Bundles	11 15 0 per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 7 6

Galvanized Working Up-Sheets:

	£ s. d.
24 G., f.o.b. London, in Bundles	13 15 0 per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co. Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.
Crown Bars	6 10 0 per ton.
Best Bars (1 to 6in. wide, above ½ in. thick, ½ in. to 4 round and squares)	7 0 0
Angles	6 15 0
Best	7 5 0
T's	7 0 0
Best	7 10 0
Best Shoe Iron	8 0 0
Rivet Iron	8 0 0
Best Rivet (Special)	9 5 0
Cable	9 5 0
Screwing	8 5 0

	£	s.	d.
Best Turning	8	0	0 per ton.
„ Plating	6	5	0 ..
Best Best	9	5	0 ..
Treble Best	10	5	0 ..
Plates	7	10	0 ..
Best Plates	8	10	0 ..
„ Boiler Plates	9	10	0 ..
Best Boiler Plates	12	0	0 ..

Delivery to: Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon.,
quote: "Star" brand patent wrought nail, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6½ cent. off 3½ pound.
40 per cent. off 3½ inch to 7-inch strong rose and 10d. and 20d. pound.

40 per cent. off all sharp-pointed nails.
Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt. d/d any Railway Station.

4 cwt. lots and upwards 9/9 per cwt. d/d any Railway Station.
Steel cut nails, 3-inch basis:—
2 tons 8/3 per cwt. d/d any Railway Station.
4 cwt. lots 8/6 per cwt. d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbrwrla,
quote:—

	Per Box.	f.o.b. Wales.
Coke Tin-plates.	£	s. d.
C 18½ by 14 124s. 110 lb. "BV"	0	12 ½
C 20 by 10 225s. 155 .. "Jumbo"	0	17 6
C 20 by 14 112s. 108 .. "Lydbrook"	0	12 ½
C 28 by 20 112s. 216 .. "Lydbrook"	1	4 6

Charcoal Tinplates:

C 20 by 14 112s. 108 lb. "Allaway" 0 | 12 ½ |

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Point, Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d.
Blooms	at	3	12 0 per ton.
Billets	at	3	14 0 ..
Sheet Bars	at	3	16 0 ..

Finished Steel:

Bars	at	5	0 0 per ton.
Angles	at	5	1 0 ..
Tees	at	5	4 0 ..
Joists	at	4	10 0 ..
Flaming Standards	at	5	2 0 ..
Shear Bars	at	5	4 0 ..
Tyre Bars	at	5	4 0 ..
Half-Round Bars	at	5	5 0 ..
Heavy Rails	at	4	15 0 ..
Light Rails	at	4	17 6 ..

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.	£	s.	d.
English Ingots, f.o.b.	133	0	0 to	133	10	0 per ton.
Dis. 1½ & 1	134	0	0 to	134	10	0 ..
English Bars, f.o.b.	134	0	0 to	134	10	0 ..
Dis. 1½ & 1	133	5	0 to	133	7	6 ..
Strait, G.M.B., each Warehouse, Net	132	2	6 to	132	5	0 ..
Straits G.M.B., 3 months, Warehouse, Net	133	5	0 to	134	5	0 ..
Australian, Mt. Bischoff, Warehouse, Net						

COPPER.

Copper:	£	s.	d.	£	s.	d.
Standard G.M.B., cash Warehouse, Net	67	15	0 to	67	17	6 per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	2	6 to	68	5	0 ..
English, Tough, Cake & Ingot, Warehouse, Net	70	15	0 to	71	5	0 ..
English, Best Select, Warehouse Net	71	15	0 to	72	5	0 ..
English, Sheets and Sheathing, f.o.b., Dis. 2½	80	0	0 to	80	10	0 ..
English, Sheets for India, f.o.b., Dis. 2½	76	0	0 to	76	10	0 ..
Electro, Warehouse, Net	70	15	0 to	71	0	0 ..
Ore, ex ship	0	12	0 to	0	13	0 per unit.
Regulus, Matte and Precipitate, ex. ship, ...	0	13	3 to	0	14	0 ..

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½	0	0	6½ per lb.			
Sheathing	0	0	6½ ..			

SPELTER.

	£	s.	d.	£	s.	d.
Silesian output, Net	25	15	0 to	26	0	0 per ton.
Blende of 50%, Net	6	11	6 to	6	15	0 ..
Calamine, Net	6	14	0 to	6	15	0 ..

LEAD.

	£	s.	d.	£	s.	d.
English Pig, Warehouse, Dis. 2½	12	5	0 to	12	1	0 per ton.
Spanish, ex ship, Dis. 2½	12	0	0 to	12	2	6 ..
Lead Ore of 70%, Net	6	2	6 to			

ANTIMONY.

	£	s.	d.	£	s.	d.
Star Regulus, f.o.b., Dis. 2½	36	0	0 to	36	10	0 per ton.
Ore, 50%, ex ship, Dis. 2½	8	10	0 to	9	10	0 ..
Crude, ex ship, Dis. 2½	13	10	0 to	14	0	0 ..

QUICKSILVER.

	£	s.	d.
Spanish, 7½ lb. Warehouse, Net	7	12	6 per flask.
Italian	7	11	6 ..

COAL.**LEICESTERSHIRE.**

The Nailstone Colliery Company, Leicester,
quote. Price per Ton at Pit of 20 Cwt., with $\frac{1}{2}$ Cwt. per
Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston
quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts ($\frac{1}{4}$ to $\frac{3}{4}$)	9	6
Small Nuts ($\frac{1}{8}$ to $\frac{1}{4}$)	6	0
Rough Brights	6	0
Peas ($\frac{1}{8}$ to $\frac{1}{4}$)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

	s.	d.
Low Main Brights	7	6
" Nuts	7	3
Hard (Good Steam Coal)	8	0
Bakers' Nuts ($1\frac{1}{2}$ to $2\frac{1}{2}$)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross,
near Chesterfield, quote:—

	per ton at pit.	s.	d.
Best Main Coal	10	6	
Best Silkstone	10	0	
Best House Coal	8	6	
Best House Nuts	8	0	
Treble Screened Cobbles	7	9	
Best Cobbles	7	3	

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham,
quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.**HIGH HAZEL.**

London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, $\frac{1}{2}$ to 2 in. cube	5	6

STEAM — TOP HARD.

Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.**CHEMICALS.**

Messrs. S. W. Royle and Co., Albert Square,
Manchester, quote:

	£	s.	d.
Acids: Oxalic	0	0	24 per lb.
Picric Crystals	0	0	11 "
Tartaric	0	0	10½ "

	£	s.	d.
Acetate of Lime: Brown at Manchester net	9	10	0 per ton.
" Grey	11	10	0 "
Alumina: Alum, Lump, loose	5	5	0 "
" " in casks	5	7	6 "
" Ground, in bags	5	15	0 "
Sulphate of Alumina, 14%	4	10	0 "
Ammonia: Carbonate	0	0	3½ per lb.
Muriate Grey f.o.b. Liverpool	24	0	0 per ton.
Sal-ammoniac, Lump, 1sts, del ^d . U.K.	42	0	0 "
" 2nds, ...	40	0	0 "
Sulphate	13	2	6 "
Arsenic: Best White Powdered	12	5	0 "
Bleaching Powder, 35%	4	10	0 "
Borax: British Refined Crystal	12	0	0 "

Coal Tar Products:

Benzole, 50/90 %	0	0	6 per gal.
" 90%	0	0	7 "
Carbolic Acid Crystals, 34/35° C.	0	0	6 per lb.
" " 39/40° C.	0	0	6½ "
" Liquid, 97/99 %	0	0	9 per gal.
" Crude, 62½ % at 60° F.	0	1	9 "
" f.o.b.	0	0	1½ "
Creosote, ordinary good liquid	0	0	3 "
Naphtha, Crude, 20 % at 120° C.	0	0	8 "
" Solvent, 90% at 160° C. f.o.b.	0	0	9 "
" " 95 % at 160° C.	0	0	10 "
" " 90 % at 190° C.	0	0	10 "
" Rectified, flash point over 73° F. f.o.b.	0	0	11 "
" Rectified, flash point over 100° F. f.o.b.	1	0	0 "
Naphthalene, all qualities	1	11	6 per ton.
Pitch	0	12	6 "
Copperas: Green, in bulk	1	19	0 "
" barrels f.o.b. L'pool	1	2	6 "
Cake	22	15	0 "
Copper: Sulphate	0	0	7½ per lb.

Cyanides: 98% minimum .. f.o.b. net 0 0 7½ per lb.

Lead: Acetate (Sugar) White, English	27	10	0 per ton.
" " Foreign c.i.f. U.K.	24	5	0 "
" " Grey	21	15	0 "
" " Brown at Manchester	17	0	0 "
Nitrate	24	0	0 "
Litharge, Flake	15	10	0 "
" Powder	16	0	0 "
Red Lead, Genuine, c.i.f. London less 5%	15	10	0 "
White	16	15	0 "

Naphtha (Wood): Miscible, 60 o.p. 0 2 10 per gal.
Solvent

Potash: Bichromate... delivered England...	0	0	3 per lb.
Carbonate, 90/92 % c.i.f. Hull ..	18	10	0 per ton.
Caustic, 75/80 % net ..	20	15	0 "
Chromate	0	0	3½ per lb.
Montreal	35	0	0 per ton.
Prussiate, Yellow	0	0	5 per lb.

SELECTED PATENTS.

Compiled expressly for this journal by Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C., and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 5s.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

3466. F. T. Edgcombe, Glasgow. Feb. 20th.—An improved apparatus for steering and manoeuvring ships.

3469. J. M. McClellon, U.S.A. Feb. 20th.—Improvements in and relating to water-tube boilers.

3472. E. C. Villiers and W. H. Smith, Windsor. Feb. 20th.—Improvements in steam generators or boilers.

3475. P. Decor, London. Feb. 20th.—Improvements in or relating to rotary engines and the like and means for regulating the same.

3484. R. Burrow, London. Feb. 20th.—A grip wrench.

3487. H. H. Riggins, G. A. Patton, and J. T. Patton, Kingston-on-Thames. Feb. 20th.—An improved wrench.

3504. H. H. Lake, London. Feb. 20th.—Improvements relating to tube plates for steam generators. (*Cf. J. Ingers, U.S.A.*)

3519. E. Beckert, London. Feb. 20th.—A new or improved method and apparatus for riveting small links, pins, pivots, and the like.

3524. G. M. Harroway and W. Dixon, London. Feb. 20th.—Improvements in ship construction.

3545. E. Mackay, Glasgow. Feb. 21st.—Improvements in and connected with indicators for steam, gas, petrol, and other engines.

3551. J. W. Glover, St. Helens. Feb. 21st.—An improved arrangement of machinery for driving, lifting, hauling, and loading (including hoisting, winding, and unloading).

3557. G. Glossop, Sheffield. Feb. 21st.—Jam-thread lock nut.

3581. W. H. Longsdorf and F. E. Jordan, London. Feb. 21st.—Improvements in and relating to steam generator and other furnaces.

3610. Siemens and Halske Akt.-Ges., London. Feb. 21st.—Manufacture of tools for working wood, metal, stone, or the like. (Date applied for Feb. 25th, 1904.)

3621. H. F. Weinland, London. Feb. 21st.—Improvements in boiler tube cleaners.

3626. H. C. Tryon, London. Feb. 21st.—Improvements in pipe couplings.

3627. H. Gilardoni and H. Leriche, London. Feb. 21st.—Improvements in speed gear. (Date applied for Feb. 22nd, 1904.)

3642. L. Baron, F. T. Bertwistle, and W. H. Spencer, Blackpool. Feb. 22nd.—A new or improved form of sand valve for tram and road cars and other power driven vehicles.

3657. S. B. Halcombe, P. MacGregor, J. Ainley, and W. O. Carrier, Sheffield. Feb. 22nd.—Improvements in the sealing of metals.

3659. H. Lister, Birmingham. Feb. 22nd.—Improved means for indicating and controlling the speed of steam turbines.

3668. G. A. Nussbaum, London. Feb. 22nd.—Improvements in turbines actuated by elastic fluid.

3679. J. Holt, Birmingham. Feb. 22nd.—Improvements in screw propellers for ships, launches, and the like craft.

3680. A. H. Pehrson, London. Feb. 22nd.—Improvements or additions to the production of bars, rods, tubes, blanks, and the like drawn from metal.

3682. S. Chandier, J. Chandier, and J. H. Solomons, London. Feb. 22nd.—An improved form of safety and by-pass valve for steam condensers and other gas pumps.

3684. E. Michael, London. Feb. 22nd.—Means for equalising the pressures in pumping and similar piston stroke engines.

3695. T. W. Hill, London. Feb. 22nd.—Improvements in horizontal shafts.

3701. D. Roberts and C. James, London. Feb. 22nd.—Improvements in chain grate stokers.

3710. H. P. S. Wise and B. U. Boate, London. Feb. 22nd.—Improvements relating to variable speed gears.

3722. W. H. Porter, Manchester. Feb. 23rd.—Improvements in gas engines giving an impulse cycle stroke.

3723. J. P. Barker, Liverpool. Feb. 23rd.—Improvements in or connected with cooling ships at sea.

3732. W. Youdan and J. Tinsley, Sheffield. Feb. 23rd.—Improvements in devices for supporting colliery cages in case of accidents.

3739. J. Bedford, Sheffield. Feb. 23rd.—Improvements in the manufacture and treatment of compound armour plates.

3744. A. W. Knight, London. Feb. 23rd.—Improvements in racks and washers.

3764. W. B. Thompson, Dundee. Feb. 23rd.—Improvements in or relating to governors.

3770. J. Craig, London. Feb. 23rd.—An improved method of obtaining motive power.

3776. F. W. Leevors, London. Feb. 23rd.—Improvements in stop and through-way valves.

3781. C. Goerg, Jun., and L. Christ, London. Feb. 23rd.—Improvements in and relating to rock drills.

3785. L. Silcott, London. Feb. 23rd.—Twyer-iron. (Date applied for March 7th, 1904.)

3790. L. Zamboni, R. H. Bowd, and the American Pulley Company, London. Feb. 23rd.—Improvements in or relating to pulley frames.

3800. A. V. Downton, Erith. Feb. 23rd.—A new or improved stranding machine or machines for stranding up of copper, iron, steel wires, and the like.

3807. W. G. A. Bijl, London. Feb. 23rd.—Improvements in or relating to riveting machines.

3811. C. Brvanti, London. Feb. 23rd.—An improved form of link, hook, coupling, or connector.

3821. A. C. E. Rateau, London. Feb. 23rd.—Improvements in means for the propulsion of screw steamers. (Date applied for March 1st, 1904.)

3822. A. C. E. Rateau, London. Feb. 23rd.—Improvements in apparatus for governing engines driven by steam from different sources at different pressures. (Date applied for March 2nd, 1904.)

3823. G. B. Hunter and W. M. Webster, London. Feb. 23rd.—Improvements in and relating to movable stages for building purposes.

3833. J. Wood, Liverpool. Feb. 23rd.—Improvements in apparatus for preventing overwinding at counters, mums, and other places.

3840. C. Davies, Blaenavon. Feb. 24th.—Haulage clip.

3866. W. M. Bocquet, Bedford. Feb. 24th.—Improvements in blast pipes for steam locomotive engines.

3867. K. Lomax and J. Tomlinson, Manchester. Feb. 24th.—Electrical apparatus for automatically controlling the pressure of steam in boilers.

3872. H. Green, Tondou, Glam. Feb. 24th.—Improvements in the axle boxes of railway and tramway rolling stock and other vehicles.

3883. J. Corbett and F. B. Kilpatrick, Glasgow. Feb. 24th.—Improvements in pumps.

3886. J. H. Wynn, London. Feb. 24th.—Improvements relating to adjustable spanners.

3892. W. R. Smith, London. Feb. 24th.—Improvements in elastic limiters.

3916. W. P. Thompson, Liverpool. Feb. 24th.—Improvements in check valves. (*Cf. Schmitt, U.S.A.*)

3926. E. Eberhardt, London. Feb. 24th.—Improvements in or connected with mud tube haulers. (Date applied for May 1st, 1904.)

3937. **C. Greenhalgh, Bolton.** Feb. 25th.—Screw propeller for turning ships.

3944. R. Kennedy, Glasgow. Feb. 15th. -Improvements in utilising exhaust gases from internal combustion engines and in apparatus therefor.

3953. C. W. Siddle and L. Cousen, Huddersfield.
Feb. 25th.—Improvements in or appertaining to dimensional or variable speed gears or motions.

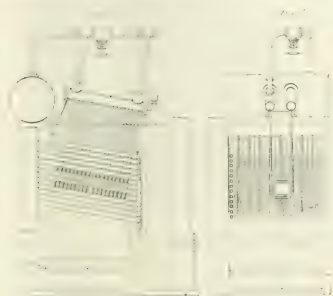
3959. J. Parker, Huntington. Feb. 25th.—Steam engine

3961 A. H. Moorhouse, Manchester. Feb. 27th. In-
crements in screw-down valves

RECENT SPECIFICATIONS.

SUPERHEATERS.

Willans and Robinson, Ltd., and A. T. Bennett, of Rugby, March 10th, 1904.—This invention is especially applicable to vertical tubular furnaces, in which the tops of the tubes are not rendered inaccessible by being covered over by the steam and water drum. The superheater consists of two small drums, conveniently consisting of solid metal tubes a few inches in diameter, with end covers bolted on to flanges. The two drums lie side by side upon the top of the boiler, and are connected by U-shaped tubes, one end of each tube being expanded around each drum. The two drums may be of convenient fixed or flexible

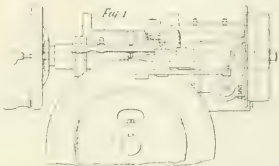


LATHES.

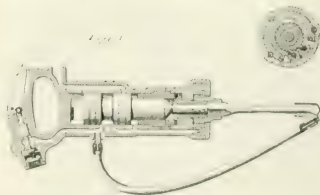
Alfred Herbert and P. V. Vernon, of Coventry.
March 14th, 1904.—The object of this invention is to provide a feed motion which will change automatically with the changes of speed of the driving pulley, and to retain the same rate of feed for a wide range of rate for the high speed of the main shaft independent of variation in the rate of feeding speed and the improvement consists in—

Combining the feed mechanism with the main driving pulley when the latter is rotated, The mechanism and gearing of the invention is as follows:—The shaft is provided with a worm wheel which is driven by a worm on the main worm shaft of the reduction clutch provided on the main worm shaft, and means for engaging or disengaging by hand the parts of the self friction clutch. The main worm shaft is provided with a sliding clutch which can be rotated, and a sliding secondary worm shaft driven by worm gear the main worm shaft. A quick-speed driving pulley and a sliding clutch revolving thereon are loosely connected on the main worm shaft, and means are provided for engaging or disengaging by hand a clutch on the main worm shaft are described. A nest of toothed

gears are loosely mounted on the sliding secondary worm shaft, and a nest of toothed gears keyed on an auxiliary shaft and always gearing with the aforesaid nest of toothed gears on the secondary worm shaft. A spring key is provided in a slot in the sliding secondary worm shaft, and means for giving a sliding motion to the said



Lake communication from Ingersoll-Sergeant Drill Company, of New York. Dated 8-1-61. This invention relates to an improvement in drills and has for its object to provide certain improvements in that class of drills known as hammer drills. The present invention consists in providing a drill with a handle, which handle is provided with the usual sleeve for the motive fluid and controlling device thereon. A duct leads from the handle to an inlet port opening into the chamber in position to be brought into open communication with the one or the other of two ports through an annular circumferential groove in the piston. The piston is provided with a tapered profile so that it will seat tightly against the inner wall of the cylinder. A hammer is pivoted between tubes



NEW PUBLICATIONS.

"THE PROCESS YEAR-BOOK."

Penrose's Pictorial Annual, 1904-5. Edited by William Gamble. Penrose and Co. 4s.

The relationship between this "illustrated review of the graphic arts" and engineering may not at first sight be very apparent; but engineers who are called upon to undertake the production of catalogues will find the above annual at once suggestive and useful. In fact the volume actually includes some very fine specimens of the engravers' art, as applied to the representation of machinery. Three-colour work as usual provides the dominant interest, the present volume reaching a high level considered as an art production. Incidentally we are reminded once more how much the printer and illustrator owe to the engineer. The volume itself is a remarkable specimen of typography, in view of the fact that every line of it has been turned out by the Lanston Monotype Machine. Among the articles is a retrospective account of the routing machine, which, to quote the author, has "been transferred from an awkward machine, that roughly hewed out the wood with no pretence of efficiency, into a wonderful piece of mechanism gliding into a plate with a cutter revolving at the rate of fourteen or fifteen thousand revolutions per minute, capable of piercing the most acute angles, and of executing the minutest work with the highest degree of efficiency."

"POCKET BOOK OF MARINE ENGINEERING RULES AND TABLES."

For the use of Marine Engineers, Naval Architects, Designers, Draughtsmen, Superintendents, and all engaged in the design and construction of marine machinery, naval and mercantile. By A. E. Seaton and H. M. Rounthwaite. Eighth edition. Charles Griffin and Co., Ltd. 7s. 6d.

In this new edition the editors have exercised due discretion in the task of revision, the result being that the value of this pocket book is still further enhanced. All the recent alterations and additions to the rules of the Board of Trade, Lloyd's Registry, the Bureau Veritas and the British Corporation have been included. Marine engineers will find the new formulae and tables relating to the speed of ships of practical utility in determining more accurately the horse-power necessary for the speed of all kinds of steam vessels. The book which is illustrated, is suitably bound in limp leather.

We have also received "The Bi-Monthly Bulletin of the American Institute of Mining Engineers" (Philadelphia),—"Arc Lamps and How to Maintain Them," by E. Smithson and E. R. Sharpe (S. Rentell and Co., Ltd. 1s.). An elementary booklet compiled by two experienced electricians for the use of those having charge of arc lamps; without going deeply into electrical matters, the writers impart sufficient information to enable a "handy man" to negotiate small breakdowns, and secure the maximum amount of light for a minimum expenditure of capital.—"The Oil Mills Directory, 1905-6," being a list of oil manufactures in Great Britain, including extractors, boilers, distillers, etc. (Simpkin, Marshall, Hamilton, Kent and Co., Ltd. 2s. 6d. net.) A handy volume, containing technical details of the firms engaged in the oil and allied industries.

BOOKS RECEIVED.

Gas and Petroleum Engines. Translated and adapted from the French of Henri de Gramont. Edited by A. G. Elliott, B.Sc. With fifty-three illustrations. Whitaker and Co. 2s. 6d.

The Engineering Diary and Pocket Magazine, February 1905. (17, Bonville Street, E.C.) 6d.

The Imperial Dictionary and Statistics of Electric Lighting Power and Traction Works in operation or projected in Great Britain and Ireland, India, and all the British Colonies. By C. S. Vesey Brown. Hazell, Watson and Viney, Ltd. 12s. 6d. net.

The Mining Year-Book, 1905. Edited by A. N. Jackson. Published by The Financial Times' Ltd. 15s. net.

The Inventory, Guide to Patent Law and the New Practice. By James Roberts, M.A. LL.B. John Murray. 2s. 6d.

CATALOGUES.

Mr. Fred J. Down, M.I.E.E., F.C.S., A.M.I.C.E., of 6, 7, and 8, Crutched Friars, E.C., draws attention in a circular to his gear shield, a method for retarding wear on new gears and arresting excessive wear on gearings.

Messrs. David Bridge and Co., of Castleton, Manchester, forward a booklet containing over seventy illustrations of india-rubber and gutta percha machinery. The firm give particular attention to the designing of special machinery for carrying out manufacturers' own private processes of machinery.

Special Circular No. 9 of the Consolidated Pneumatic Tool Company, Ltd., illustrates and describes the firm's "Little Giant" and "Whitlow" Pneumatic Drills, the Boyer Hammer, Improved Rock Drills, Stone Hammers, etc.

The Kennicott Water Softener Company, 20 Great St. Helen's, E.C. We have received from this firm an attractive little booklet describing their "Tipping Box" type of Water Softener. It is claimed that the entire cost of softening water by the Kennicott system averages from 1d. to 2d. per gallon and gallon.

Mr. Henry Milnes of Ingley Works, Bradford, illustrates and describes his various lathes, accessories and machine tools in a handy booklet. This is well arranged and the compiler has also given at the benefit of an index. The printers are Messrs. Arthur Stannard and Co., of Central Works, Denton, Manchester.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, MAR. 10.—Rugby Engineering Society, 8 p.m.: Paper, "The Minute Structure of Metals." Mr. J. T. Milton. Physical Society, Royal Society, Royal Institution, Paper, "Structure of the Atom." Professor L. F. Thompson. F.R.S. Civil Engineers, Great George Street, S.W. 8 p.m. (Students Meeting) 1. Mr. F. G. Halsey, "The Purification of Sewage." 2. Mr. F. O. Kirby, "The Purification of Sewage by Hydrolysis and Oxidation." Astronomical, Burlington House, W. 8 p.m.: Physical Society, South Kensington, S.W. 8 p.m.: Paper, Dr. C. Chree, "The Stresses in the Earth's Crust before and after the Sinking of a Bone-Hole." Mr. J. Morrow, "The Latent Vibration of Bars of Uniform and Varying Sectional Area." Mr. A. Campbell, "Direct Reading Resistance Thermometers, with an Appendix on Composite Thermocouples."—Manchester Local Section Electrical Engineer's Annual Luncheon.

SATURDAY, MAR. 11.—Royal Institution, Albemarle Street, W. 3 p.m.: Electrical Properties of Radio Active Substance. Professor J. J. Thompson.—Manchester Association of Engineers, Grand Hotel, 8 p.m.: Paper, "Recent Developments in Locomotives." Mr. Samuel Rendell, Junior. Institution of Engineers, 3 p.m.: Visit to New Fitz Hotel, Piccadilly, to inspect the "cage-skeleton" system of constructional engineering.

MONDAY, MAR. 13.—Institution of Marine Engineers, Romford Road, Stratford, 8 p.m.: Paper, "The Development of the Torpedo-Boat Destroyer," Mr. J. W. Harding.

TUESDAY, MAR. 14.—University of Liverpool Engineering Society: Paper, "The Theory of the Internal Combustion Engine." Professor Burstell.—Institution of Electrical Engineers, Glasgow Local Section: Manchester Local Section.

WEDNESDAY, MAR. 15.—Dundee Institute of Engineers, Paper, "Dynamics and Motors from the Users Point of View." Mr. David Scott.

THURSDAY, MAR. 16.—Institution of Electrical Engineers (Local Section): Paper, "Power Gas." Dr. F. H. Bowman.—Institution of Mining and Metallurgy.

FRIDAY, MAR. 17.—Institution of Mechanical Engineers, Storey's Gate, 8 p.m.: Presentation of Report of Steam Engine Research Committee.

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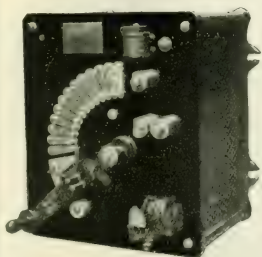
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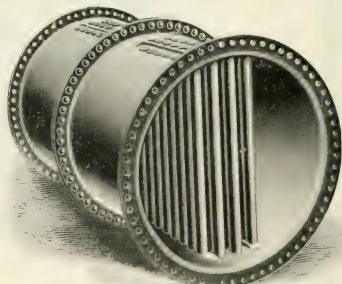
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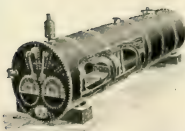
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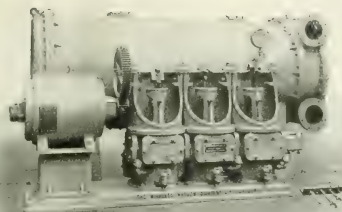
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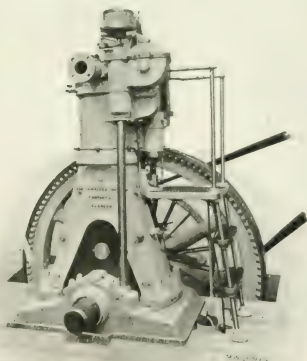
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SMOOTH RUNNING,
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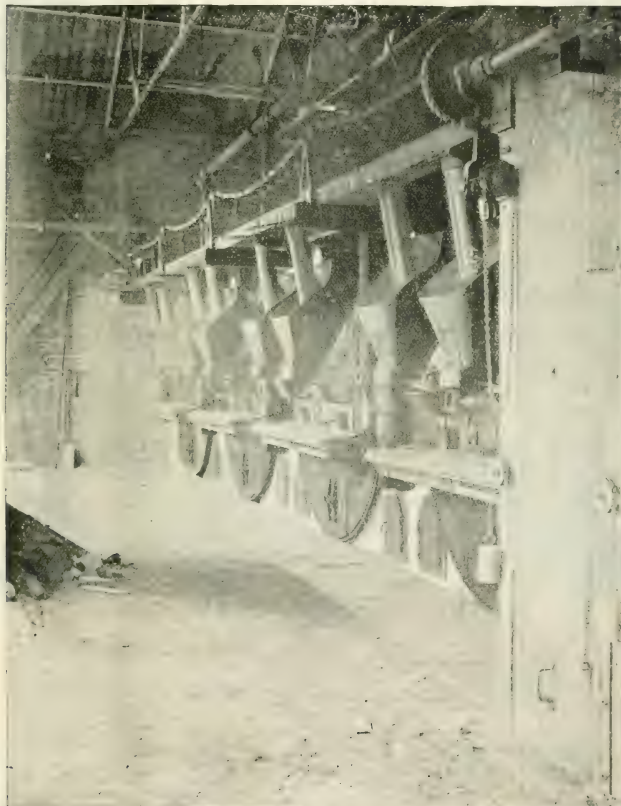
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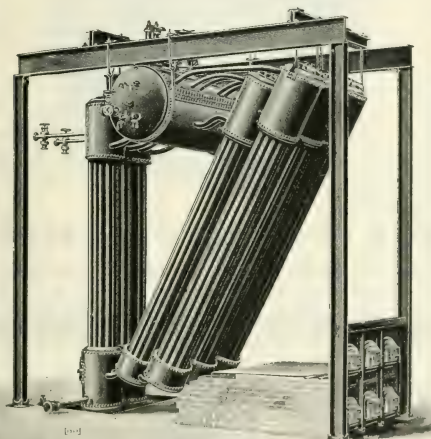
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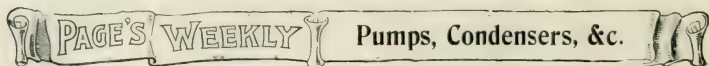
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MADE IN ALL SIZES TO EVAPORATE 3,000
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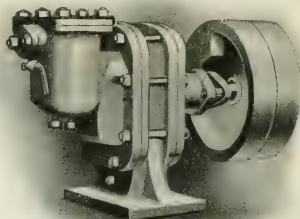
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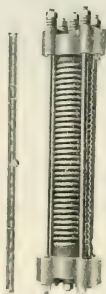


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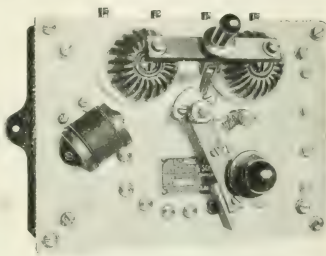
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This Switch provides, at a very low cost, the means of starting and regulating our Fans with perfect safety, even in inexperienced hands, **it being impossible to turn on the power** without all the resistance being in circuit.

Prices of Patent Safety Switch.

Size of Fan.	Voltage.	Price.
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30 in.	100 to 110 ..	3 4 6
"	200 to 250 ..	3 5 0



Telephone. 2579 Royal

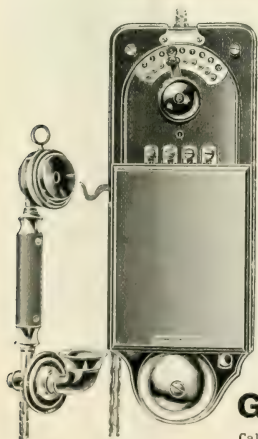
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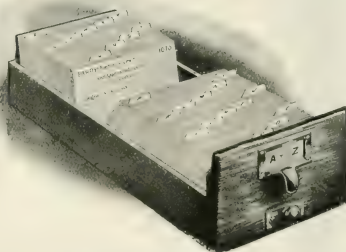
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An advertisement for Arthur Stafford & Co. The top half features the company name "ARTHUR STAFFORD & Co" in large, bold, serif letters. Below this, in smaller letters, is "FINE ART & GENERAL PRINTERS". To the left of the text is a black and white illustration of a woman in a long dress and hat, sitting at a desk and pointing with her right hand towards a framed picture on the wall. To the right of the illustration, the text "Illustrated Catalogue & Half-Ton-Printing a Speciality" is written in a cursive script. Below this, in bold serif letters, is "DENTON MANCHESTER". At the bottom right of the illustration, there is a small signature "J. H. LITTLE" and the date "1905".

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*Have you
seen what a
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*If you have
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THE LYLE COMPANY, LIMITED,

HARRISON STREET, GRAY'S INN ROAD,

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PAGE'S WEEKLY

Miscellaneous

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Your advertisements and catalogues ought to tell your story as convincingly as you tell it to the caller who wants to do business.

But do they? If you are not satisfied with the results of your advertising, may we offer you our assistance? We can make type talk for you; and it will not be a one-sided conversation. We will make the other people reply.

Write us—

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Can save at least **5%** ON THEIR WAGES BILL, and thousands of employers do so by the use of the

"Dey" Time Registers

which are automatic machines for registering the hour and minute at which Employees start and finish work,

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The "DEY" combines on **THE ONE MACHINE** the good points of all other Automatic Time Recorders on the market.

They are of British Manufacture Throughout.

They are absolutely the best Time Recorders in the World.

They are the cheapest up-to-date machine on the market.

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THEY COMPEL PUNCTUALITY.

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A firm using 15 machines writes: "We shall be sorry when we change the boiler-shop machine, as it was one of the earliest, and has had the roughest of usage together with the maximum of vibration, and rudest of shocks; but it has gone on working the whole time (nearly six years) night and day, and when it goes to you for repairs, it will be the first time it has been in the infirmary."

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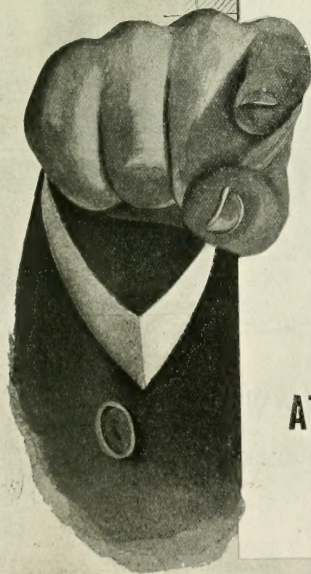
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Send for Descriptive Pamphlet to the Sole Manufacturers in Europe.

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53, DERBY ROAD,
38, WELL STREET,
19, ROYAL EXCHANGE SQUARE,

LONDON, E.C.
LIVERPOOL,
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W. C. HOLMES & Co.,

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Sole Makers of the . .

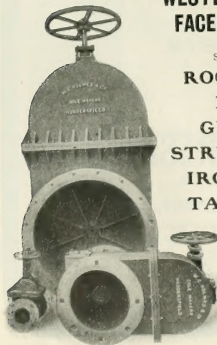
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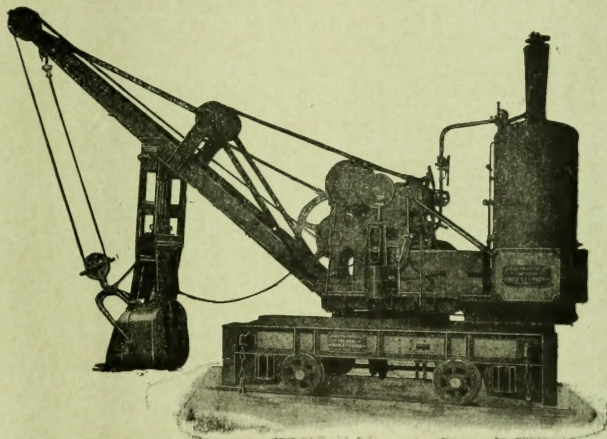
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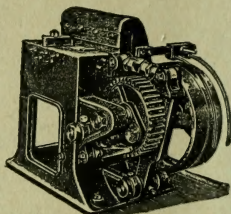
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